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VOLUME 80 • APRIL 2008 • NUMBER 8

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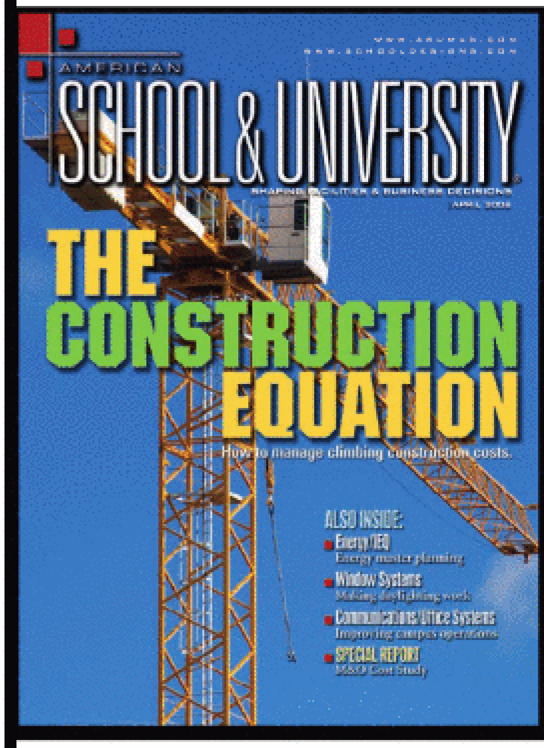

Clarification

The Notable in the "Frugal Flow" feature in the March issue, pg. 34, incorrectly states that 0.5 is the total gallons of water used in one standard toilet flush. Although FLUSHMATE toilet technology uses as little as 1.0 gallon per flush (gpf), and Sloan Flushometers for single-flush water closets are as low as 1.28 gpf, the current government standard for toilets is 1.6 gpf. The standard for urinals is 1.0, but urinal Flushometers now utilize as little as 1 pint per flush. Also, please note that the high-use flush modes mentioned in the "To flush or not to flush" sidebar are available for select sensor-operated urinal flush valves only.

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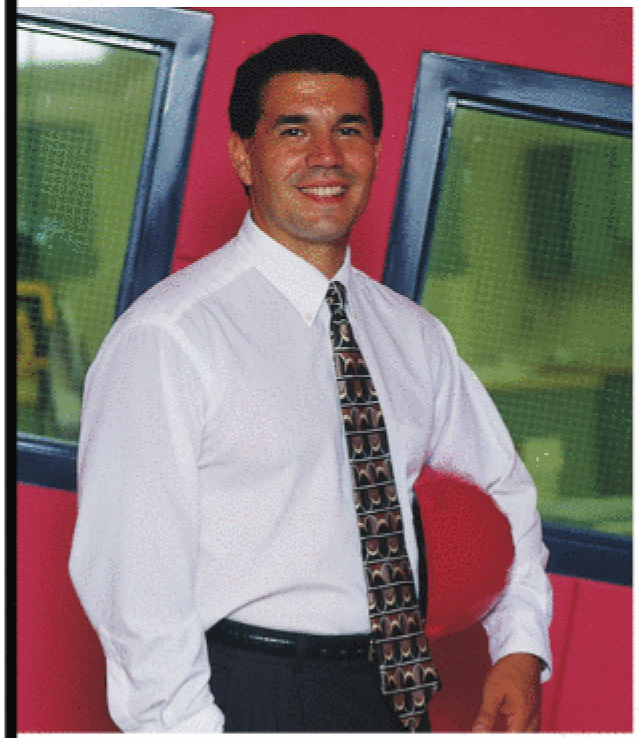

Last month, Vista Unified (Calif.) school officials announced that a much-anticipated new high school campus originally scheduled to open for the 2008-09 school year would not open until the following year.

The inability to open is not because of construction delays, unexpected building costs or the discovery of some endangered species on the site. The $91 million Mission Vista campus will sit unopened and unused because the district does not have the money to operate the facilities.

At the Folsom Cordova district (Calif.), a new $3 million pool at Vista del Lago High School sits unused. Completed in early February as a key amenity at the new $100 million school, district officials determined it could not afford to heat or operate the facility.

As surprising as such scenarios may seem, they are happening more and more. In the midst of robust education construction activity, some communities are finding out the hard way the difference between capital funding and operating budgets.

The disconnect between capital funding for major construction projects and operating budgets once a new facility is opened continues to flourish—often with embarrassing consequences. After years of planning and spending tens of millions of dollars, a community watches as an exciting new building sits unopened and unused because adequate planning and funding to operate the facility were not secured as part of the original capital program.

Institutions often look at construction costs with little consideration for the resources required to open and operate a new facility. Even those administrators that diligently consider life-cycle costs of a building often find themselves having to forgo best practices because of pressures to keep the initial cost of a program as low as possible—which can result in no plan for funding to operate the building once it is completed.

This shortsightedness needs to stop, and we need to close the disconnect between capital costs and operating costs—embracing life-cycle costs of any and every education construction project early in the planning stage. ■

jagron@asumag.com

WEB 101

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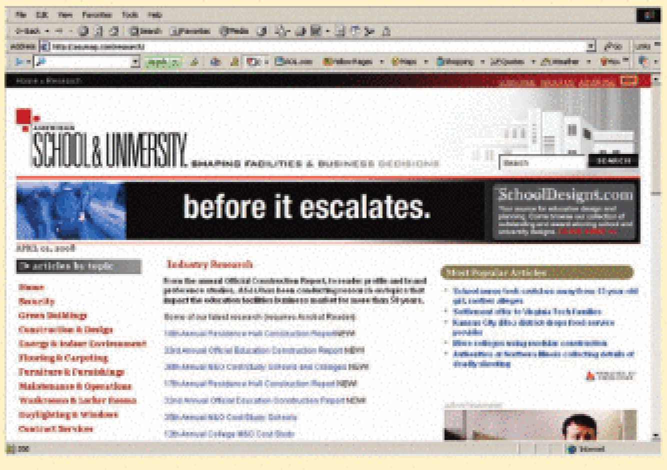
Have some research of your own? Comment at our blog: http://blog.asumag.com/schoolhouse_beat/—*Susan Lustig*



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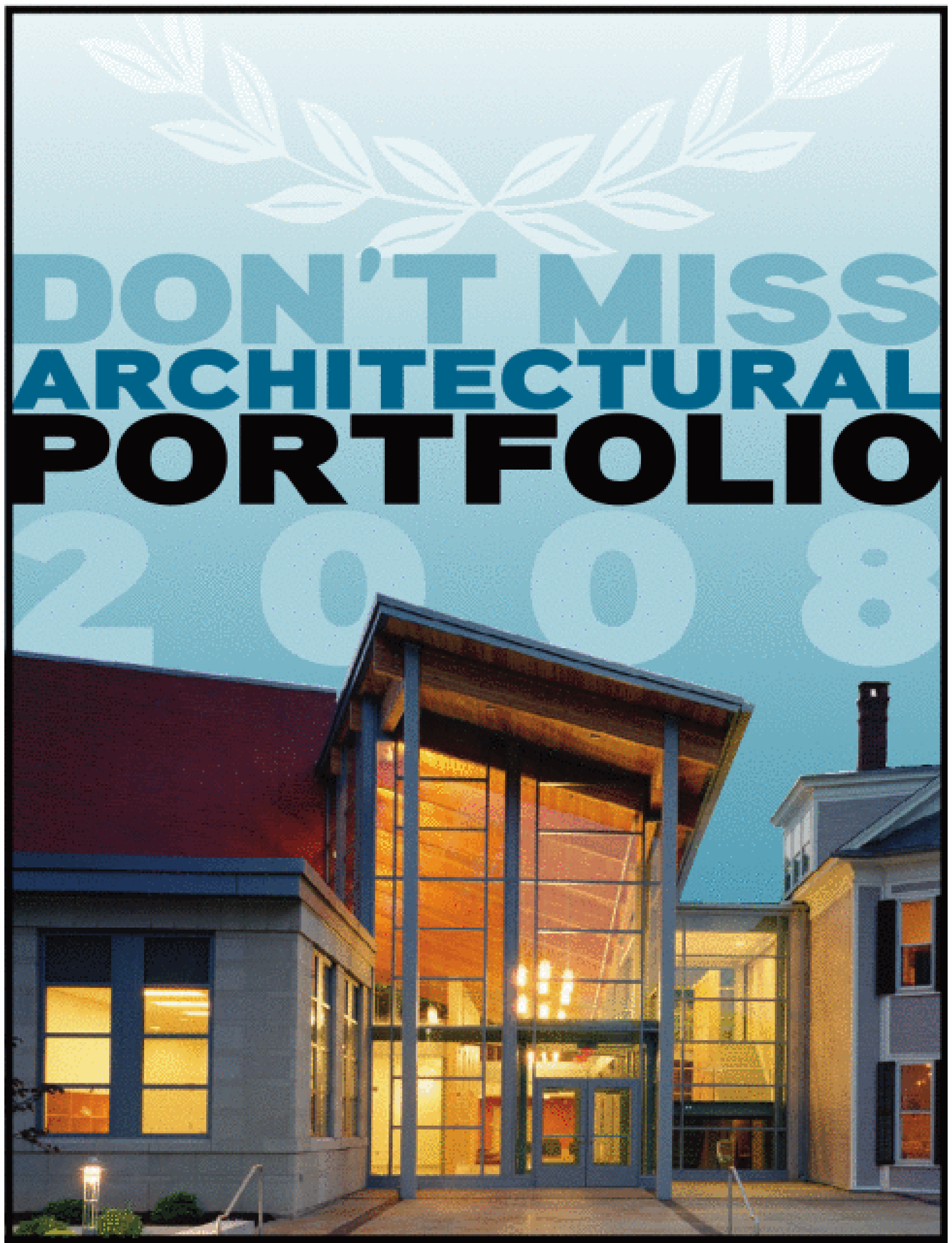

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INSIDE: SECURITY

CAMERA COVERAGE IN CHICAGO

City and school officials in Chicago hope to boost security on public school campuses by giving city police real-time access to school camera surveillance.

"When this program is fully implemented over the next few months, we will have a comprehensive school security system that will make it far easier for us to respond more quickly and effectively to any emergency at a school building," says Chicago Mayor Richard M. Daley. "They will provide an additional set of eyes and ears to our efforts to protect our students."

The school system has more than 4,500 cameras inside and outside about 200 of its 650 school facilities. Before the announcement, only school district officials could see the surveillance in real time. Now the Chicago Police Department and the city's Office of Emergency Management and Communications will be able to monitor the video.

That will enable first responders to an emergency to see real-time video from inside and outside a building on their portable data terminals.

Daley noted that city police will routinely monitor only exterior cameras. Officers will view the interior camera surveillance only when emergencies occur.

INITIATIVE FOCUSES ON CAMPUS RISKS

The National Association of College and University Business Officers (NACUBO), along with other organizations, has begun a campus safety and security project that will assess wide-ranging risks common to all higher-education institutions.

The association says the study will explore key safety and security threats and offer guidance to help campuses prepare for potential trouble, including information on preparing emergency-management plans. The assessment will cover potentially devastating events such as natural disasters, infectious diseases, shootings, terrorist attacks and cyber attacks.

"For the next 12 months, we'll conduct research through a survey of a cross section of colleges and universities to identify the current state of emergency preparedness," says James Hyatt, project director. "The project team will also do onsite research by visiting a diverse set of campuses."

NACUBO's partners in the effort are APPA, EDUCAUSE, the American College Personnel Association, the Association of Governing Boards of Universities and Colleges, the International Association of Campus Law Enforcement Administrators,the National Association of College and University Attorneys, and the University Risk Management and Insurance Association.

STRONGER SECURITY SOUGHT

A task force on campus security in the University of California system says schools could provide safer campuses by pursuing improvements in student mental-health programs, emergency communications, preparedness and response, and prevention and hazard mitigation.

The Report of the University of California Campus Security Task Force was commissioned last year by University of California President Robert Dynes after the deadly shooting rampage at Virginia Tech. The task force says the system has already taken many steps to bolster campus safety, but notes several areas where security could be enhanced.

Among the suggested improvements for campuses:

•Complete a "gap analysis" that inventories and evaluates current emergency communications practices, capabilities and needs to identify and close any gaps.

•Assess public safety responder levels and equipment to determine if a campus has sufficient resources for a rapid and effective response to an incident.

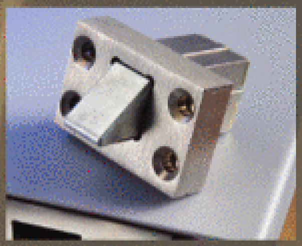
•Conduct a security survey of existing facilities and prioritize needed improvements. ■

WHO'S PATROLLING THE CAMPUS?

Number of college campuses with more than 2,500 students	750
Percentage of those campuses with sworn police officers	74%
Percentage of campuses with armed law-enforcement officers	67%
Percentage of campuses with 24-hour patrol	98%
Percentage of campuses with a three-digit emergency number	95%
Percentage of campuses with blue-light emergency phones	91%

Source: "Campus Law Enforcement, 2004-05," U.S. Justice Department, Bureau of Justice Statistics, February 2008

FEMA RATED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Light-filled study

The Estelle M. Black Library at Rock Valley College, Rockford, Ill., recently has re-emerged as a campus destination. The library once was dark and outdated, but a 60,100-square-foot renovation completed last July has made it an inviting space for students.

One key goal of the project was to create a more open, connected feel within the library. A new glass-faced entry displays library activity to those in the parking lot. A light-filled commons area next to the library attracts students from bordering classroom buildings. The commons offers a coffee bar and lounge seating to enhance campus life, and to promote student interaction and study, and a curved sheet of glass displays the library.

A floor-to-ceiling glass wall and a 20-foot by 20-foot skylight bring natural light to both levels. Stacks were moved to the center, opening up spaces for study along the periphery. Study zones on both levels offer views to nature, as well as other campus buildings. Enhanced zoning separates quiet study areas from more active areas.

The architect is Legat Architects, Inc. (Chicago and Crystal Lake, Ill.)

Rock Valley College, Rockford, Ill.
Photo courtesy of James Steinkamp/Steinkamp Photography

Alliance Francaise de Miami. Photo courtesy of Wilk Marketing Communications

A fresh image

A renovation and revitalization project has transformed a former printing facility and an adjacent property into the Alliance Francaise de Miami, a not-for-profit organization whose mission is to promote the French language and culture through the operation of a language school and other educational activities, encouragement of international travel and cultural exchanges.

The cultural and educational center houses 14 classrooms; a reception area/lobby atrium; library; bookstore; a large multi-purpose and event space; offices; two meeting rooms; catering kitchen; and a retail component that includes a sidewalk cafe, travel agency and hair salon.

The design challenge was to economically rehabilitate two old industrial structures to accommodate new uses, all while creating an exciting, fresh image for the center. The buildings were renovated and reused in order to take advantage of existing resources and to maintain some of the original character of the older building's facade on the streetscape.

The color palette was influenced by the colors of the French flag: blue, white and red. The red- and blue-clad towers read through from the exterior to the interior, as a contrast to the sloping white roof and predominately white walls. The interior finishes are simple and were chosen for durability, ease of maintenance and budgetary considerations. Natural light was an important design concept.

The architect is Hellmuth, Obata & Kassabaum, Inc. (Miami), and the general contractor is Mc Gowan Builders, Inc. (Coral Gables, Fla.) Structural engineer is Bluss & Nyitray, Inc.

Location: Miami's "Little Havana"
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Middle-school makeover

A.V. Martinez Middle School, Romeoville, Ill., was built in the early 1970s and needed an extensive renovation to accommodate population growth, enhance learning, and update its infrastructure and security controls. These challenges were complicated further by the rigid, inflexible geometry of the school's room configurations and floor plan, which featured a main corridor that circled around the core and required "one-way" traffic to prevent congestion between classes.

The $11.7 million project eliminated this corridor, restructured the circulation path into a central hub and created functional grade-level cores within the existing building footprint. This enabled the new corridors to flow in a linear fashion into and out of the grade-level cores, and supported the school's team-teaching concepts. The central node used color, patterns and "super-graphics" to improve wayfinding in the building.

The 261,000-square-foot remodel also included the consolidation of administrative and student services into a common area and the addition of new, flexible classroom spaces to accommodate curriculum changes. Most of the construction work was completed in a phased approach over summer months in 2006 and 2007 to minimize classroom disruptions.

The architect/construction manager is Wight & Company (Darien, Ill.).

A.V. Martinez Middle School, Romeoville, Ill. Photo courtesy of George Lambros Photography

Wagner College, Megerle Science Building, Staten Island, N.Y. Photo courtesy of Peter Johnston

Inspiring design

Prior to renovation, the chemistry laboratory in the Megerle Science Building at Wagner College, Staten Island, N.Y., was deficient in key areas. Storage was inadequate; hood space was not maximized; and workstations were not configured to promote student interaction or optimal instructor supervision.

The lab first was divided into two work areas: a materials preparation area, and a classroom area for lectures and conducting experiments. Air, gas, electric and vacuum outlets were moved to a central station, and workstations were redesigned so students can work with lab partners.

The result is a clean, uncluttered, spacious work surface for students to conduct experiments. A centrally positioned whiteboard promotes a unified academic atmosphere in the classroom.

The architect is Peter Johnston, Architect, PC (Hoboken, N.J.).

Contemporary styling

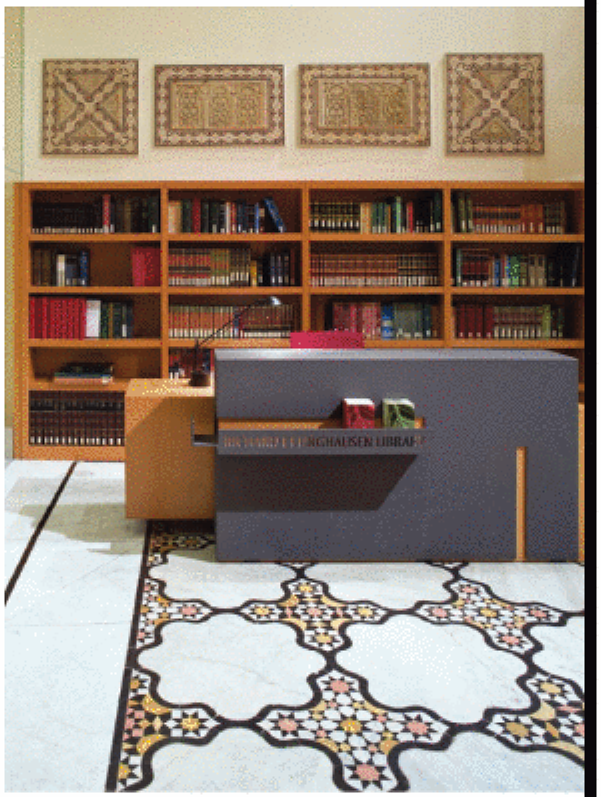
The Richard Ettinghausen Library at New York University (NYU) is housed in the Hagop Kevorkian Building, which is the center of NYU's Middle Eastern studies program. When the building opened in 1973, the school was able to incorporate architectural elements from the Quwwatli Family residence in Damascus, which was built in 1797.

The architect was asked to renovate the 2,000-square-foot library to restore it to a more active, handsome and functional space.

The design included a contemporary glass vestibule at the entrance to the building. Another glass door at the arch separates the lobby from the study area.

Custom design for the desk, study table and millwork brought organization and substance to a room that had steel shelves, a temporary desk and no formal meeting space.

The architect is Turett Collaborative Architects (New York City). ■



New York University, Richard Ettinghausen Library. Photo courtesy of Paul Warchol

KNOW-HOW

Roofing

Green roofs can enhance a building's appearance and reduce stormwater runoff.

Temple University–Ambler, Field House, Ambler, Pa. Photo courtesy of Roofscapes, Inc.

The term "green schools" is a metaphor for the movement toward environmentally friendly education facilities. But when administrators and facility managers talk about green roofs, they mean it literally—roofs covered with plants and vegetation.

As the green movement gains momentum, more schools and universities are installing green roofs. Temple University has one growing atop the Intercollegiate Athletics Field House on its Ambler, Pa., campus; the Montgomery County (Md.) district has a green roof at Northwood High School in Silver Spring.

Green roofs come in two general categories, according to the U.S. Environmental Protection Agency. *Intensive* green roofs require at least a foot of soil depth to accommodate large trees and shrubs. This type of roof adds 80 to 150 pounds per square foot of load to a building structure. *Extensive* green roofs require 1 to 5 inches of soil depth and can accommodate many kinds of grasses and vegetative cover. These roofs add 12 to 50 pounds per square foot depending on soil characteristics and the type of substrate.

Among the benefits that green roofs provide: The vegetation acts as a sponge and absorbs rain that otherwise would end up as storm water runoff, the EPA says. The soil and plants that make up the green roof also filter pollution that may be contained in the rainwater.

The Low Impact Development Center, a non-profit organization based in Maryland, lists other ecological benefits that are associated with green roofs:

•The layers of plants and vegetation conserve energy needed to heat and cool the building by providing insulation and reducing the "heat-island" effect. The layers also shield underlying roofing materials from the heat and rays of the sun, lengthening the life of a roof.

•The green vegetation lessens air pollution by converting carbon dioxide to oxygen.

In addition, a green roof usually is more aesthetically appealing than a traditional roof. In some cases, a green roof can provide a habitat for birds or other small animals.

The EPA says the upfront cost of an extensive green roof in the United States starts at about $8 a square foot. That includes materials, preparation work and installation. The cost of a traditional built-up roof starts at about $1.25 per square foot, and cool roof membranes start at about $1.50 per square foot. The green roofs require more material and labor, and the number of green roofing contractors available is limited. The EPA predicts costs will decrease as more companies work on green roofs.

Intensive green roofs will need more attention than extensive roofs, but once a green roof is established, the Low Impact Development Center says, the maintenance required is minimal. Watering and fertilizing are needed until the plants and vegetation have established themselves.

A properly designed green roof will not need cutting, the center notes, but occasional weeding, especially as the roof plants are being established, may be necessary. ■

—by Mike Kennedy

NOTABLE

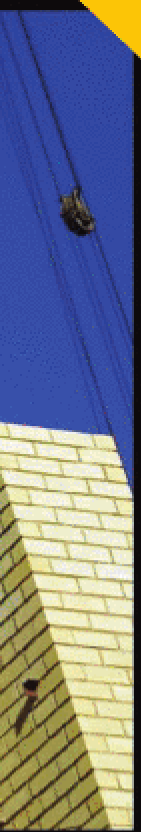
8 In dollars per square foot, the estimated cost of installing a green roof in the United States.

Source: U.S. EPA

60 to 100 Percentage of storm water retained by a green roof.

Source: Michigan State University, Green Roof Research Program

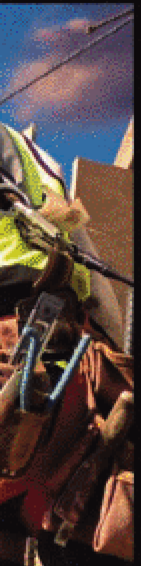
THE
CONSTR



UCTION EQUATION

BY STEVEN J. ARSHT

Effectively managing an education facility construction project starts with a plan and requires effective supervision of the budget.



Managing the costs of constructing an education facility begins well before groundbreaking—it starts with an effective project execution plan. Pre-construction planning addresses two key parts of the financial equation: developing and managing an accurate budget, and developing and executing a cost-effective procurement strategy.

Developing an accurate budget requires several pre-construction disciplines: professional estimating; value management; constructibility reviews; development of an effective construction strategy and realistic schedule; and risk analysis and contingency planning. Similarly, an effective procurement strategy depends on identifying and managing "long-lead" equipment and materials, and coordinating delivery at the optimal time in the construction process.

Building the budget

Establishing an accurate budget begins at the earliest possible stage of the project—ideally at the programming stage. An institution, design team and construction team need to work together to capture the scope and intent of the project, including the program, needs of the school or university, level of quality and sustainability goals.

A construction manager (CM) can bring the skills and experience of its professional estimators to the table. Professional estimators prepare detailed assessments at every stage of design documentation and track the design against the budget. Cost estimates are used as a tool to maintain the overall project budget and enhance the building as related to life-cycle costs, quality, building components, and the scope and cost of all building systems. Benchmarking is used to develop estimates and to verify that the estimated costs fall within the proper range for projects of that type and complexity—whether it is a classroom building, library or sophisticated research laboratory—in a particular geographic region.

Estimators typically will examine building systems first because

these have a major impact on total project cost; then they will look at the concepts behind the building design, and finally, equipment and materials. Benchmarks are developed from comparisons of projects of similar type, size, scope and location, and the architects, engineers and construction professionals review and verify the benchmarks.

However, historical data is only part of the picture. Current and projected market trends also should be tracked and applied to the estimating process. This data is gathered through regular contacts with selected subcontractors and vendors to discuss the issues that affect construction costs, including labor shortages, availability of materials, and manufacturer delivery issues. All the information affects accurate cost modeling and the development of a realistic budget.

As the project design progresses, cost estimators provide increasing levels of detail, with important milestones at schematic design, design development and construction documentation. In parallel, other members of the pre-construction planning team will develop a construction strategy, known as a project execution plan, and a schedule designed to meet the owners' target completion date within the budget.

Developing a well-structured project cost estimate and schedule in the early planning phases of a project sets the stage for effective decision-making by the project team. The pre-construction planning team should perform constructibility reviews and offer value-management alternatives on every project, whether it is a K-12 classroom building or a complex academic research lab, to identify more cost-effective ways to meet the same performance goals without sacrificing scope, quality or aesthetics.

In case of emergency

Every project also should carry a minimum of three contingency funds to cover the potential effects of future budget changes to the size or scope of the building, unforeseeable site conditions, design evolution and its related cost, and unexpected changes in the economy. In the current market, prices of materials such as copper, steel, lumber, glass and gypsum remain volatile; construction prices still are rising in certain hot spots, including Las Vegas, Salt Lake City, southern California, San Francisco, Seattle and New York City.

The owners' contingency fund (typically +/- 10 percent of total project cost) covers changes in the size or scope of the project. Under certain types of contracting arrangements, the CM may carry this contingency in its budget. The construction contingency fund is intended to cover unforeseen conditions after construction has begun; procurement deficiencies and delays, overtime should it be necessary to accelerate the schedule; and the need for additional equipment. A design-estimating contingency also is recommended and carried by the CM for resolution of design details and marketplace changes, which may occur after the issuance of the estimate. As the design progresses and costs are defined in increasing detail, the design-estimating contingency gradually diminishes until the guaranteed maximum price (GMP) is set.

Managing money

The other major part of the financial equation involves an effective procurement strategy. The pre-construction planning team should develop a procurement strategy in parallel with the development of the initial budget and schedule. The overall strategy is designed to leverage market conditions for the benefit of the project.

For example, if the size of the concrete package will put stress on a local contractor, thus inflating the price or setting back the schedule, then the team must look for ways to reduce the impact. In this case, the institution might buy the foundation from one contractor, the slab on grade from a second and the slab on deck from a third. The institution also might decide to use its purchasing power to buy the ready-mix and re-bar, and supply it to the contractors, rather

A state-of-the-art planning approach

The French Family Science Center at Duke University in Durham, N.C., includes state-of-the-art research and teaching laboratories for genomics, biological chemistry, materials science, nanoscience, physical biology and bioinformatics.

The 275,000-square-foot building has received LEED silver certification and provides space for the departments of chemistry and biology, biological anthropology and anatomy, mathematics and physics.

The center was designed to fit the specific site and to serve five surrounding buildings. The project also included a 12,000-square-foot renovation of the sub-basement level of the biological sciences building and the demolition of five existing structures.

Duke University, French Family Science Center, Durham, N.C.
Photo courtesy of Bogart & Bogart Photography

The pre-construction planning team worked closely with the design team to provide strategic analysis, cost estimating, logistics planning and value engineering for the complicated structure. For example, they determined that ceiling heights proposed for underground chemistry labs would be insufficient to accommodate ductwork associated with the fume hoods and the heating and air-conditioning systems. So the design team situated the labs in another area of the building. Based on construction estimates for a large underground auditorium, they also suggested situating it on the ground level, which reduced the cost, and enhanced user circulation and access.

The pre-construction planners also provided guidance in selecting, pricing and procuring specific systems and their components.

Working with the mechanical engineer, the team eliminated costly rooftop mechanical penthouses in favor of air handlers with factory-installed enclosures. A Canadian supplier was identified for the air-handling equipment, which at the time had the advantage of a favorable monetary exchange rate. Lab casework was procured from a Canadian supplier for the same reason.

During the design development phase, the project team developed value-management options totaling $4.6 million (total construction cost: $94.65 million), including:

•Soil-retention systems: $330,000.

•Curtainwall and windows: $300,000.

•Exterior canopies: $450,000.

•HVAC systems: $1,850,000.

•Electrical systems: $550,000.

•Plumbing systems: $700,000.

The project received LEED silver certification by including the following sustainable-design features:

•15,000 square feet of green roofs.

•94 percent of new wood certified by the Forest Stewardship Council.

•59,000 square feet of recycled carpet.

•170,000 square feet of recycled ceiling tile and 11,000 square feet of recycled metal ceiling.

•51 percent water savings resulting from waterless urinals, low-flow water closets and low-flow sinks.

•275 windows with energy-efficient glazing and reflective louvers to increase daylight penetration.

•44 percent energy reduction as a result of reflective roofs.

•Occupancy-sensor-controlled, energy-efficient lighting.

•Low-flow fume hoods operating at 80 fpm.

•Heat-recovery system that captures heat or cooling from exhaust air and uses it to pre-heat or pre-cool supply air.

CONTINUED...

than purchasing these materials from them at a higher price.

Developing a procurement strategy early in the planning phase of the project helps ensure procurement and delivery of all materials and equipment, including long-lead items, at the optimal time in the construction process. In fact, if a particular product can be obtained only from a single vendor—say the project requires an unusual piece of laboratory equipment—then that product should be ordered during the design phase. Without a strategy in place early, the project may be forced into a fast-track procurement process, with associated price premiums and delays.

Contracting for a design assist from a pre-qualified subcontractor is becoming a common way to manage the cost and scheduling of certain critical-path building systems, such as steel framing or a curtainwall. The RFP in a design-assist should require both a price for the design work, as well as a GMP to build or install the system. In the case of steel framing, this process has resulted in timely orders, as well as effective strategies to reduce total weight, thus reducing the total quantity and cost of the steel required for a project.

Sustainability matters

Education institutions have been at the forefront of the movement toward sustainable design and construction because they have realized the value of high-performance buildings in reducing life-cycle costs and enhancing the quality of the experience for users. Yet, many remain concerned about potentially higher costs of a sustainable project.

A LEED-certified building need not cost a premium if this is a fundamental goal at the outset of a project, when the design team can leverage effective site selection, building orientation and massing, and the design of the building envelope to maximize sustainability. Moreover, increasing numbers of manufacturers offer materials and equipment that are compatible with sustainable design, including efficient mechanical, electrical and plumbing systems.

Nevertheless, any project that aims for certification should include a LEED-accredited professional on the project team from day one. This special expertise is invaluable in developing a strategy to maximize the LEED score within the project budget. ■

Arsht is corporate senior vice president of pre-construction services, Skanska USA Building Inc., Parsippany, N.J. The firm was the pre-construction planning team for the Duke University project (see sidebar).

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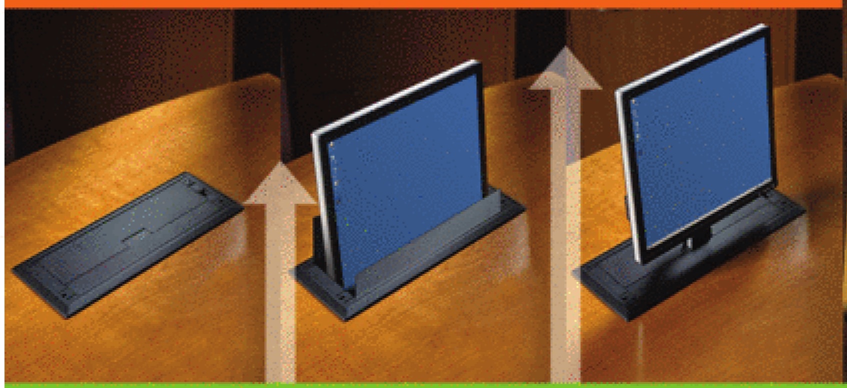

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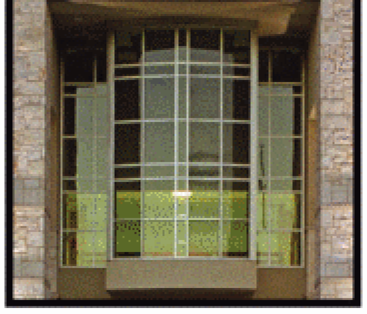


Karen Wagner High School
San Antonio, Texas

Architect: PBK
Photographer: Jud Haggard

37TH ANNUAL MAINTENANCE & OPERATIONS COST STUDY

SCHOOLS

BY JOE AGRON

As tough economic conditions and rapidly rising costs continue to strain school district budgets, spending by K-12 institutions on maintenance and operations (M&O) faces growing pressure.

The median school district allocated a smaller percentage of total district expenditures (TDE) to M&O in 2007-08—8.35 percent, down from 9.19 percent the year before, according to *American School & University*'s 37th annual Maintenance and Operations Cost Study. While lower, the 8.35 percent of TDE still is higher than the percentages allocated throughout much of the decade.

As noted last year, spending on energy/utilities remains high, reflecting skyrocketing costs to operate facilities. Rising prices also are forcing available funds to be redirected from other areas. For example, maintenance staff is being required to "do more with less"—the square footage maintained per full-time custodial worker jumped 14 percent to 26,786 from 23,408 the year before.

Following are findings from the latest M&O Cost Study that can help you in benchmarking expenditures at your institution. Data provided reflect actual spending by school districts on M&O and are not intended to be "ideal" amounts for allocations. Numerous factors—such as age and overall condition of buildings, the labor market in your area, climate, etc.—also will affect your costs when compared with the national medians.

(continued)

Maintenance & Operations Costs
(Expressed in **median** dollars **per student**)

Total Payroll	**$380.48**
Custodial**	$279.41
Maintenance**	$88.87
Grounds**	$35.99
Outside Contract Labor	**$41.70**
Total Energy/Utilities	**$299.43**
Energy (gas, electricity, other fuels)**	$246.60
Utilities**	$40.37
Trash Collection/Disposal**	$9.94
Total Equipment & Supplies	**$68.18**
Custodial/Maint. Equip. & Supplies**	$45.58
Grounds Equip. & Supplies**	$13.59
Other	**$86.55**
Total M&O*	**$876.34**
Total District Expenditures (TDE)	**$10,501**
M&O as % TDE	**8.35%**

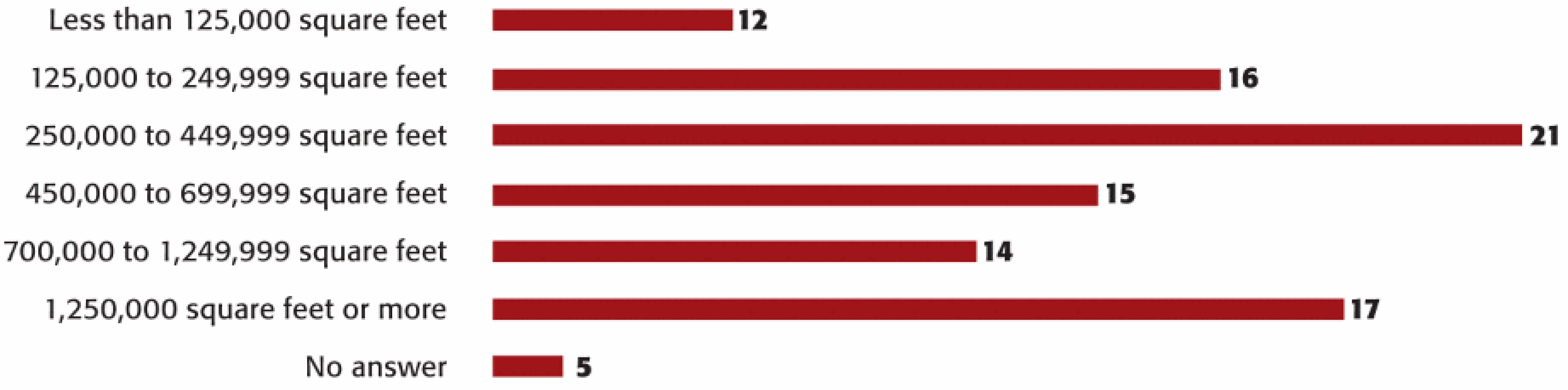
**Calculated from subtotals (in bold).*
***Based on fewer responses than the total because of schools that combine some of these categories.*

Maintenance & Operations Costs
(Expressed in **median** dollars per **square foot**)

Total Payroll	**$2.05**
Custodial**	$1.61
Maintenance**	$0.53
Grounds**	$0.22
Outside Contract Labor	**$0.21**
Total Energy/Utilities	**$1.52**
Energy (gas, electricity, other fuels)**	$1.25
Utilities**	$0.22
Trash Collection/Disposal**	$0.05
Total Equipment & Supplies	**$0.38**
Custodial/Maint. Equip. & Supplies**	$0.27
Grounds Equip. & Supplies**	$0.06
Other	**$0.40**
Total M&O Budget*	**$4.56**
Total District Expenditures (TDE)	**$58.69**

**Calculated from subtotals (in bold).*
***Based on fewer responses than the total because of schools that combine some of these categories.*

Total gross area of buildings maintained
(including corridors and other common and office areas of all district buildings) by survey respondents



Study methodology

To arrive at data for the *AS&U* Maintenance & Operations Cost Study, a detailed questionnaire was mailed in October 2007 to chief business officials at the nation's public school districts asking them to document their institutions' M&O expenditures per student and per square foot for the 2007-08 school year. Categories include:

- **Per student**: Based on total district enrollment (average daily attendance as of October 2007).
- **Per square foot**: Based on total gross area of all district buildings maintained, including corridors, offices and common space.
- **Total district expenditures (TDE)**: Amounts for the 2007-08 school year.
- **Total maintenance and operations (M&O) expenditures**: Including salaries, benefits, outside contracts, utilities, energy, trash collection/disposal, equipment and supplies, etc., for custodial, maintenance and grounds.
- **Custodial**: Those individuals responsible for building upkeep and cleaning.
- **Maintenance**: Those individuals who perform skilled jobs, such as HVAC, electrical or plumbing repair.
- **Grounds**: Those individuals responsible for landscape upkeep and maintenance.
- **Payroll**: Including benefits.
- **Average salary**: Annualized, excluding benefits.
- **Outside contract labor**: Those hired for specialized jobs to maintain or repair building systems or equipment, such as HVAC maintenance or repair.
- **Energy**: Including gas, electricity and other fuels used to operate facilities.
- **Utilities**: Including water, telephone, etc.
- **Other**: Most often identified as clerical costs, equipment repair and rental, insurance and travel.

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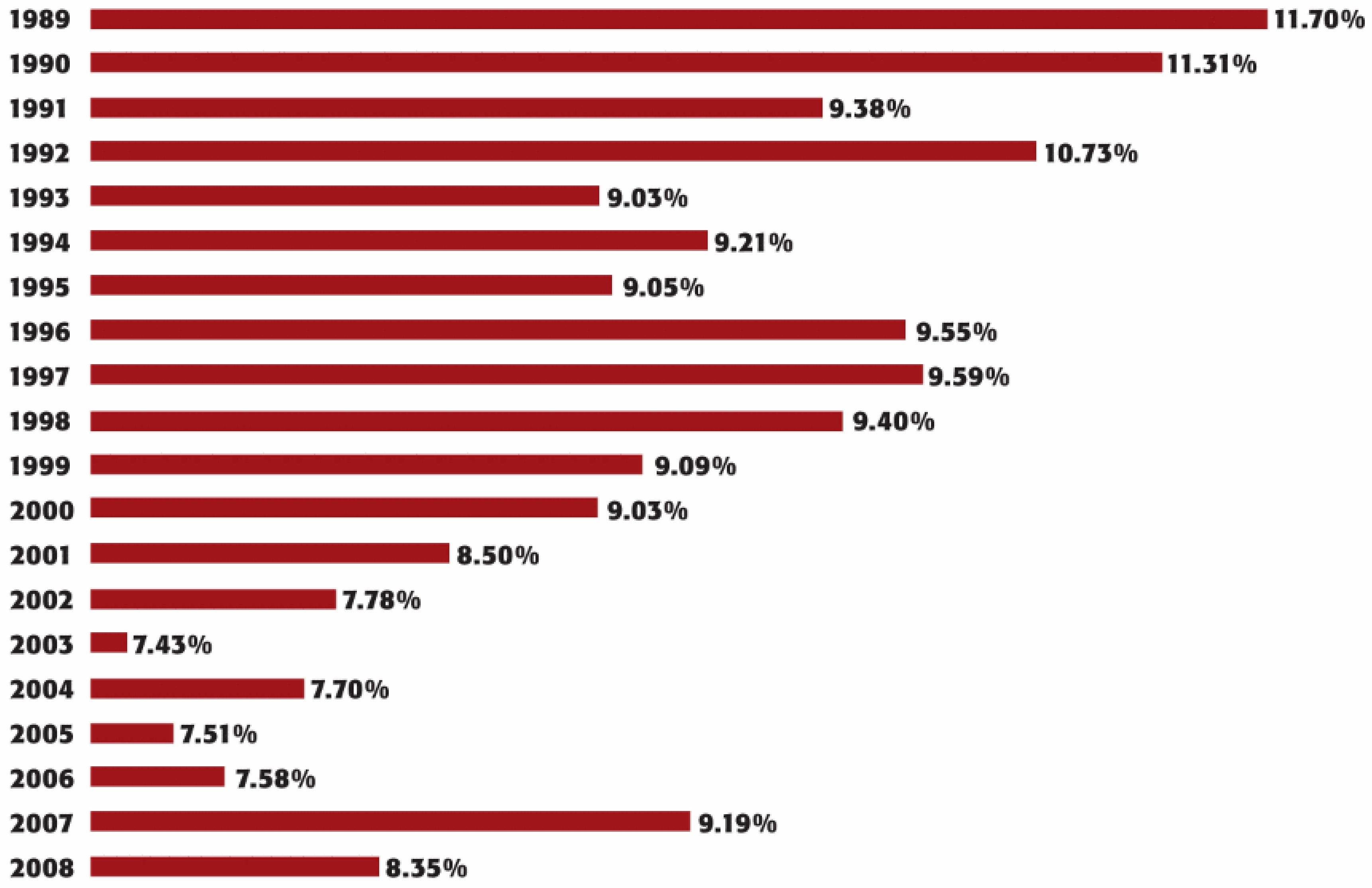
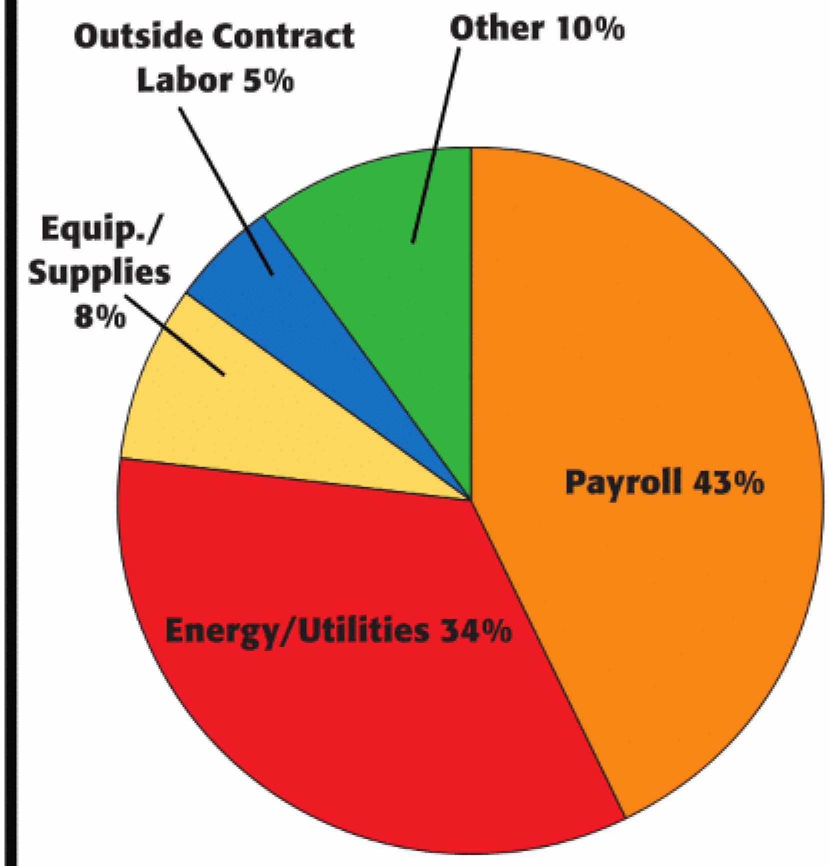
M&O expenditures—the past 20 years

Spending by school districts on maintenance and operations as a percentage of total district expenditures over the past two decades:



How the M&O budget is split

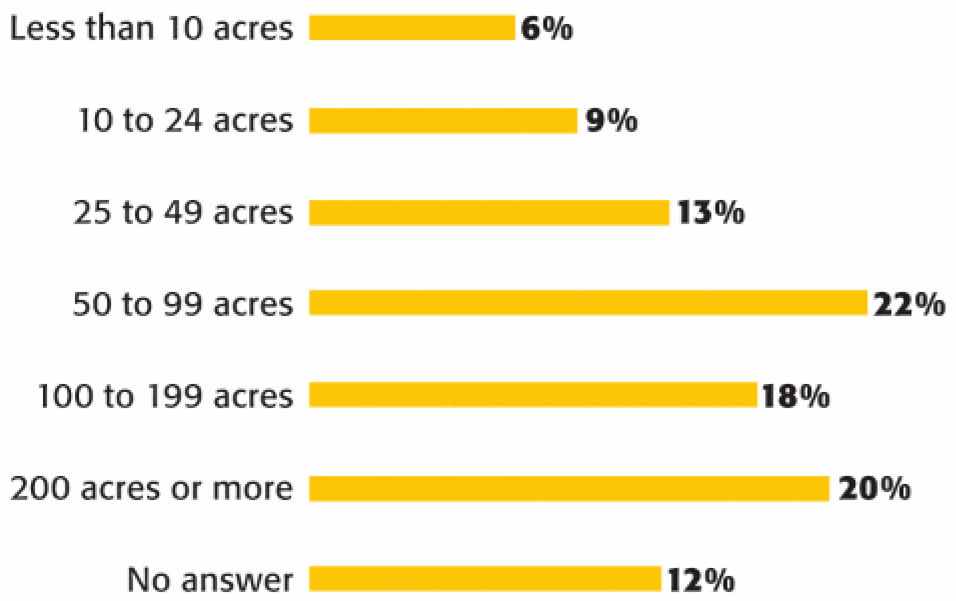
(based on median dollars per FTE student)



8,742 Mean number of students of responding school districts.

Total gross area of grounds maintained

(by survey respondents)



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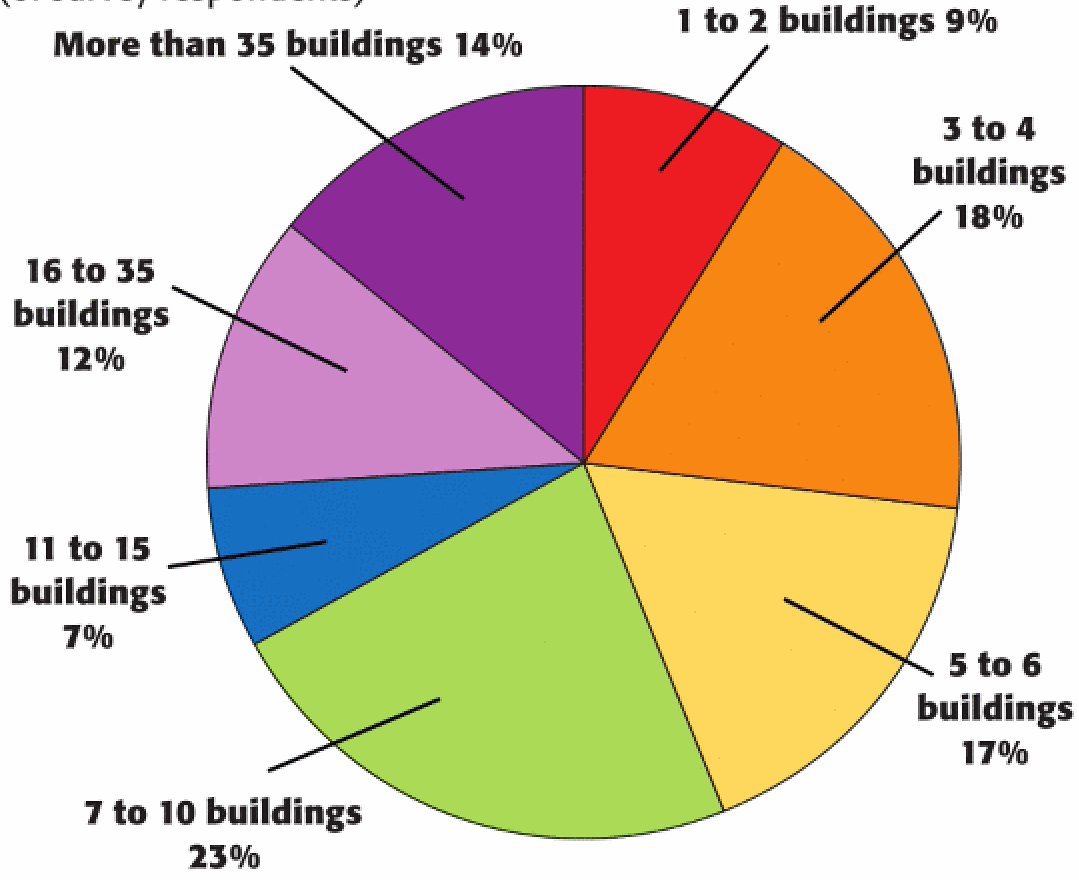
Total number of buildings in district

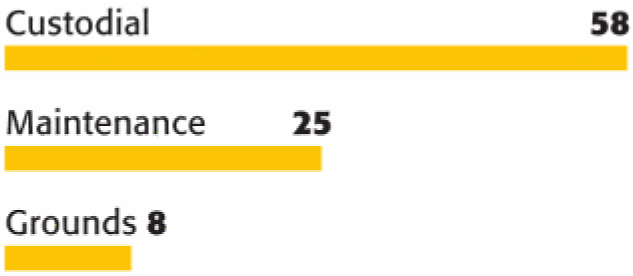
(of survey respondents)



$6.9 Mean total M&O expenditure, in millions, of responding school districts.

Personnel update

Mean number of full-time custodial, maintenance and grounds personnel at school districts:

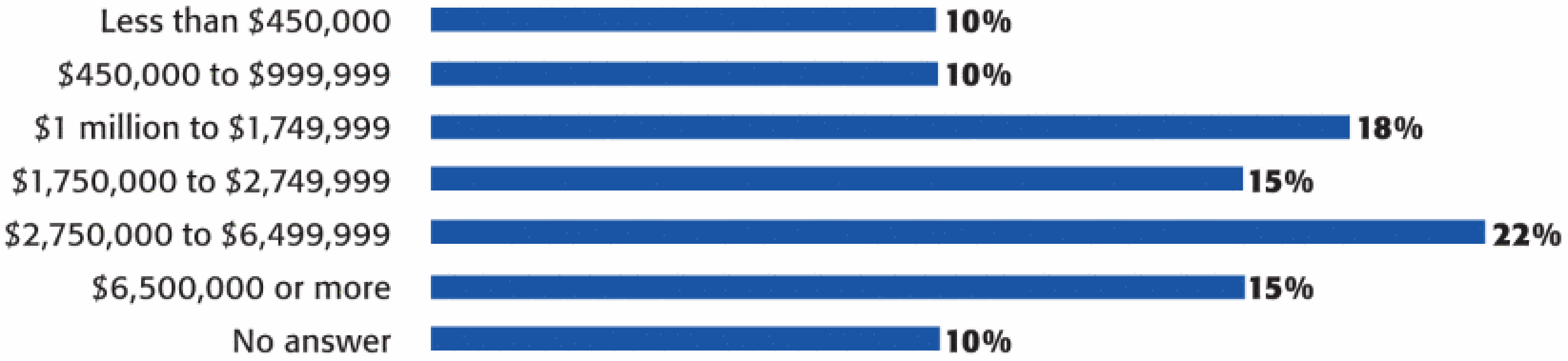


Privatizing M&O

17.7% The percentage of school districts contracting out maintenance and operations services.

Total maintenance and operations expenditures

(per survey respondents)



$1.9 Mean amount spent annually, in millions, on energy (gas, electricity and other fuels) by responding school districts.

Square-footage details

Median amount of square feet (SF) and acreage maintained at school districts:

SF maintained per full-time custodial worker	26,786
SF maintained per full-time maintenance worker	107,439
Acres maintained per full-time grounds worker	45
SF maintained per building	72,533
SF of bldg. maintained per student	177.61

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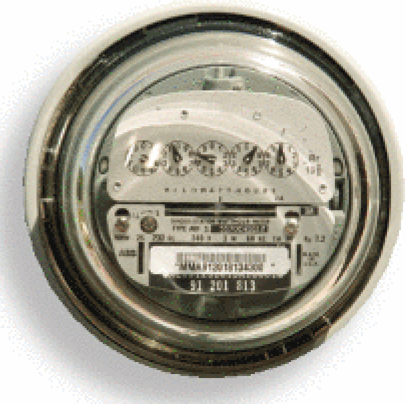

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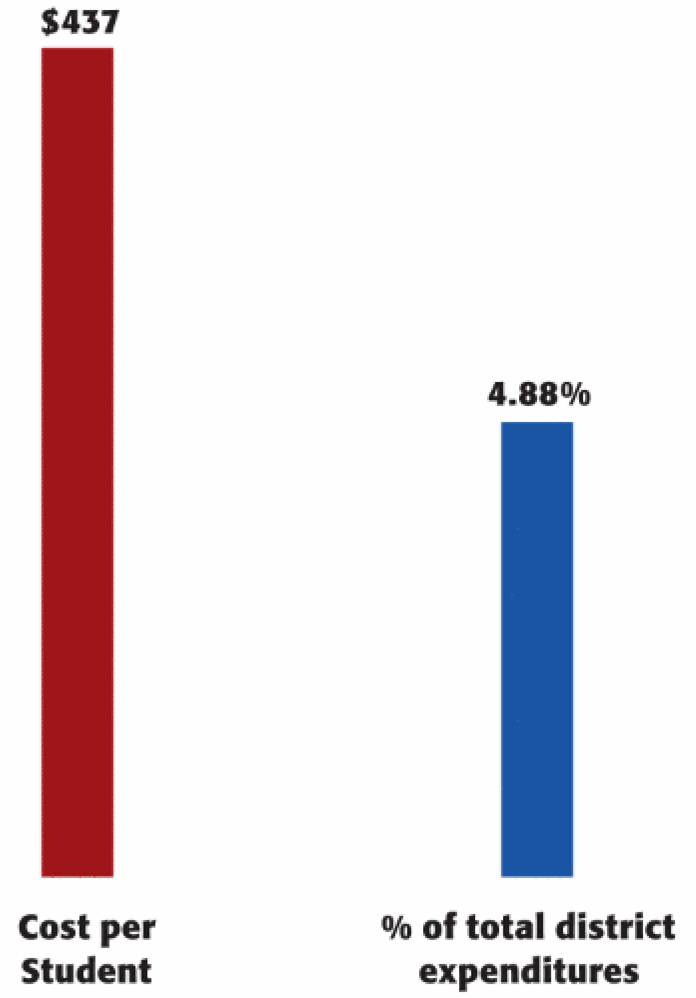
Detailing transportation costs

Median cost of transportation per student and as a percentage of total district expenditures:



1.4 Mean amount of square feet, in millions, maintained by responding school districts.

Salary update

Median salary for custodial and maintenance personnel at school districts:

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To view last year's winners, visit ASUmag.com/green.

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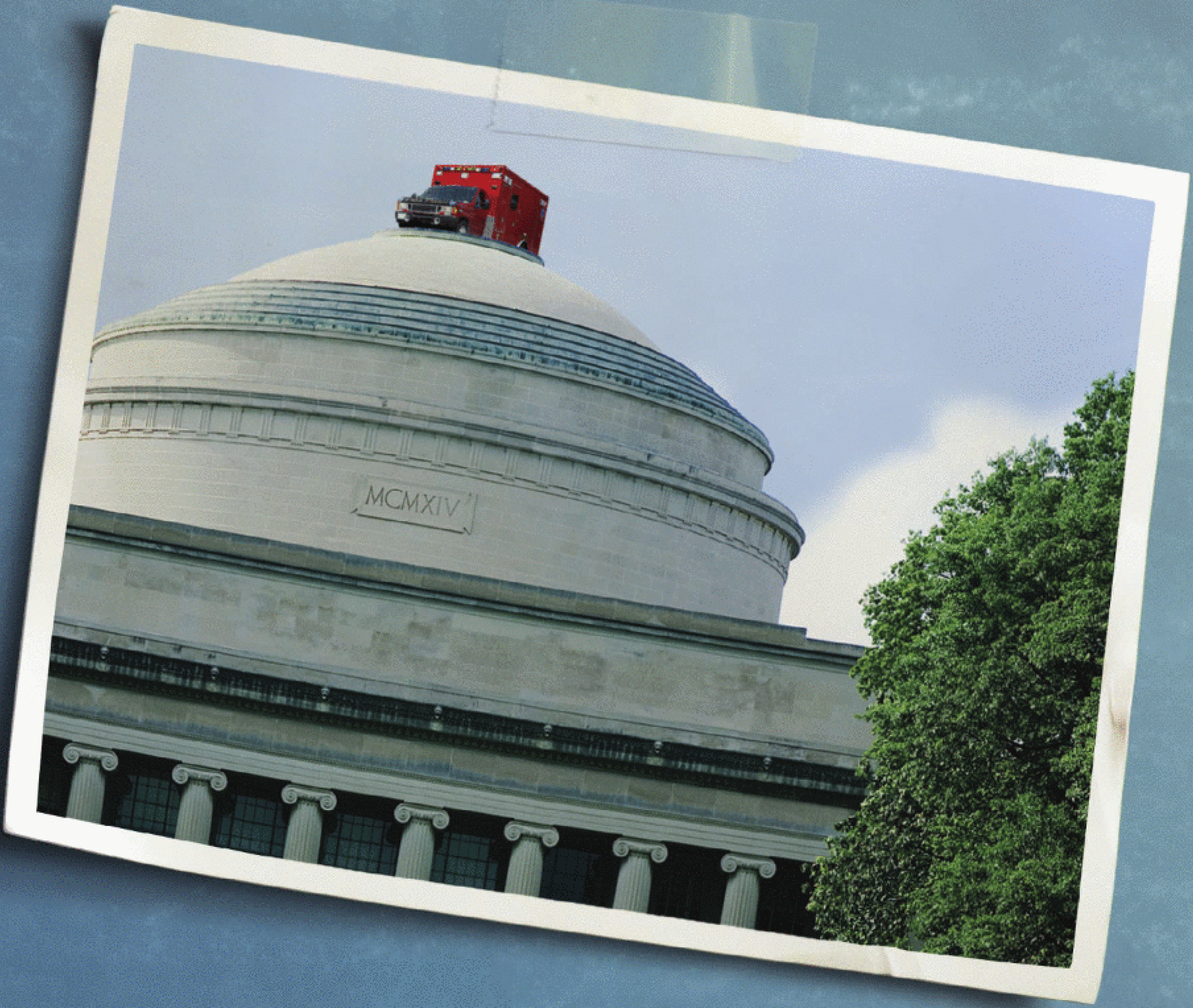

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Mt. San Antonio Community College, Science Center, Walnut, Calif.

Architect: NTD Architecture
Photographer: RMA Architectural Photographers

37TH ANNUAL MAINTENANCE & OPERATIONS COST STUDY

COLLEGES

BY JOE AGRON

Just like their school district brethren, higher-education institutions are feeling the pressure on maintenance and operations (M&O) budgets caused by difficult economic conditions and rising costs. The median college allocates 11 percent of total college budget to M&O, down from 16.4 percent the year before, according to *American School & University*'s 37th annual Maintenance and Operations Cost Study.

The area affecting M&O budgets the most is energy expenditures. Spending per full-time-equivalent (FTE) student on energy/utilities rose a whopping 24 percent from the year before. This comes after dramatic increases in the category's costs last year. Also, budget pressures are causing maintenance staffs to absorb more work. For example, the amount of square feet of building maintained per FTE student increased to a record 277 this year.

Additional data from the most recent M&O Cost Study follows, providing you with valuable data that can help you in benchmarking expenditures at your institution. Please note that the information provided only targets two-year and four-year colleges with no significant graduate programs. This is done to provide more useful comparative data. Larger four-year universities with significant graduate programs are not surveyed because their costs and activities are so varied that results would be less useful.

(continued)

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Maintenance & Operations Costs
(Expressed in **median** dollars per **FTE student**)

Salaries	**$472.22**
Benefits (based on full-time only)	**$103.07**
Total Energy/Utilities	**$540.17**
Gas/Electricity/Other Fuels**	$400.92
Utilities**	$76.25
Total Equipment & Supplies	**$110.21**
Custodial/Maint. Equip. & Supplies**	$76.81
Grounds Equip. & Supplies**	$27.41
Vehicle Maintenance	**$16.64**
Other	**$175.60**
Total M&O Budget*	**$1,417.91**
% M&O of Total College Budget	**11.0%**

**Calculated from sub-totals (in bold).*
***Based on fewer responses than the total because of schools that combine some of these categories.*

Maintenance & Operations Costs
(Expressed in **median** dollars per **square foot**)

Salaries	**$1.82**
Benefits (based on full-time only)	**$0.49**
Total Energy/Utilities	**$1.87**
Gas/Electricity/Other Fuels**	$1.60
Utilities**	$0.27
Total Equipment & Supplies	**$0.35**
Custodial/Maint. Equip. & Supplies**	$0.25
Grounds Equip. & Supplies**	$0.08
Vehicle Maintenance	**$0.06**
Other	**$0.44**
Total M&O Budget*	**$5.03**

**Calculated from sub-totals (in bold).*
***Based on fewer responses than the total because of schools that combine some of these categories.*

Study methodology

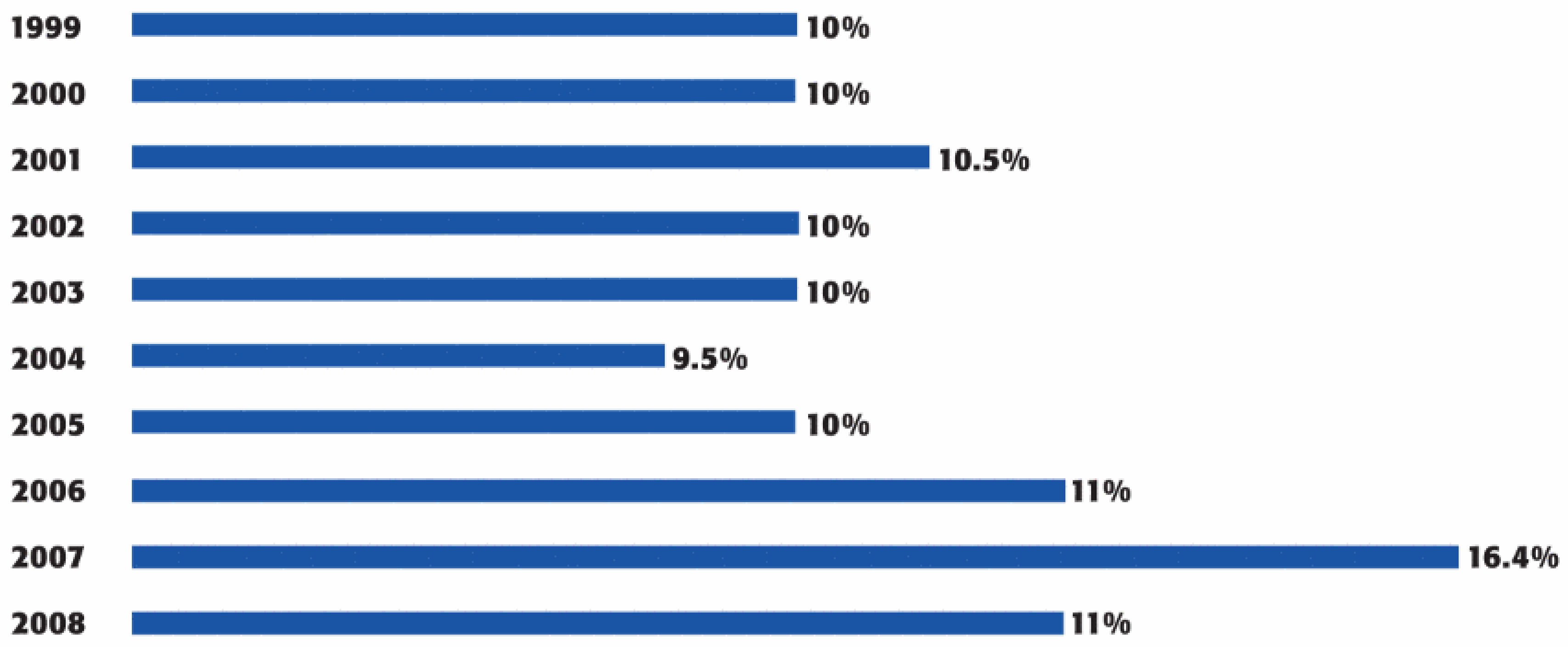
Data for the annual *American School & University* M&O Cost Study were collected via an in-depth questionnaire mailed in October 2007 to physical plant directors at two-year and four-year colleges with no significant graduate programs. Recipients were asked to document various M&O costs for the 2007-08 school year. The tables and charts detail median M&O expenditures per full-time-equivalent (FTE) student and per square foot, as well as the incidence of various maintenance practices.

Among the titles included:

- **Administrative:** Those individuals who have managerial or supervisory duties (does not include the overall director of physical plant).
- **Custodial:** Those individuals responsible for building upkeep and cleaning.
- **Maintenance:** Those individuals who perform skilled jobs, such as plumbing, electrical or HVAC repair.
- **Grounds:** Those individuals responsible for landscape maintenance and upkeep.
- **Secretarial:** Those individuals providing clerical support.

M&O expenditures over the decade

Spending by colleges on maintenance and operations as a percentage of total college expenditures over the past 10 years:



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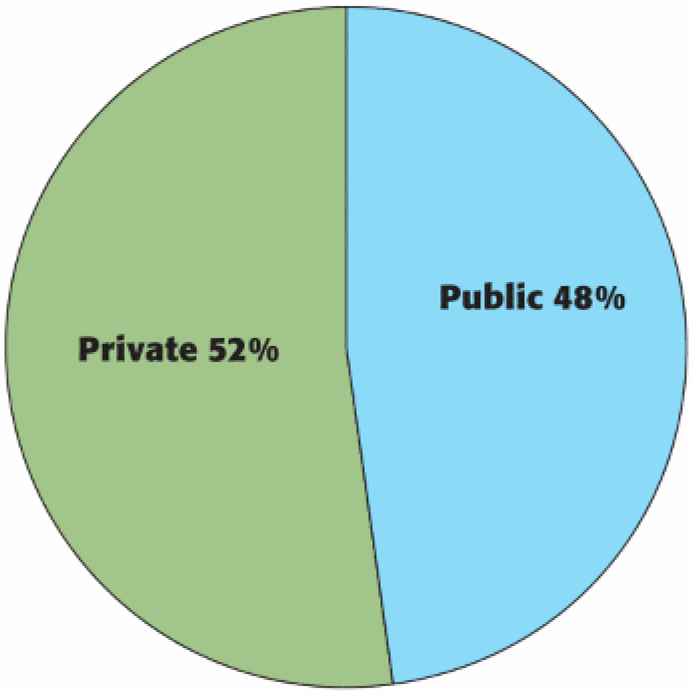
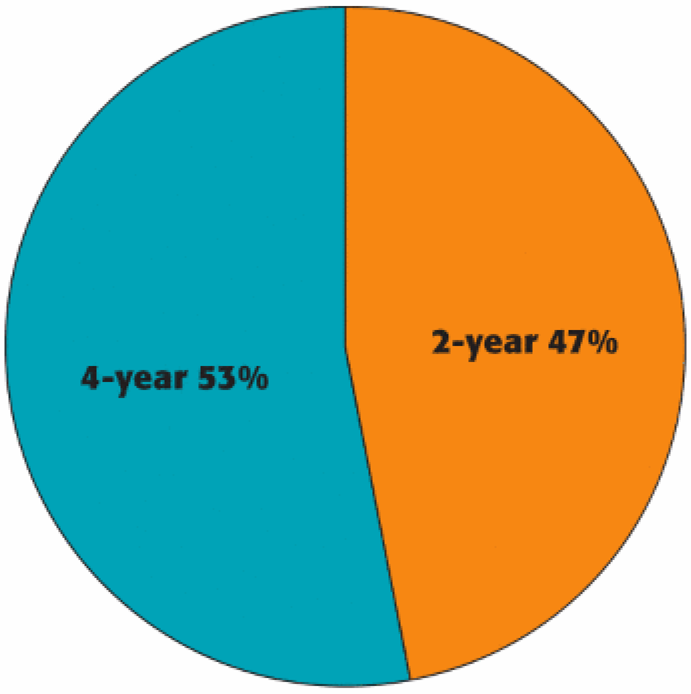
Type of institution
(of survey respondents)



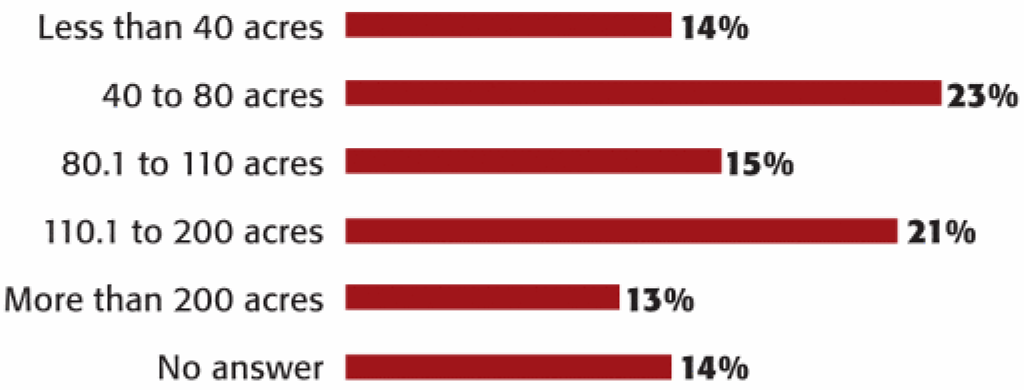


1,652 Median FTE enrollment of survey respondents.

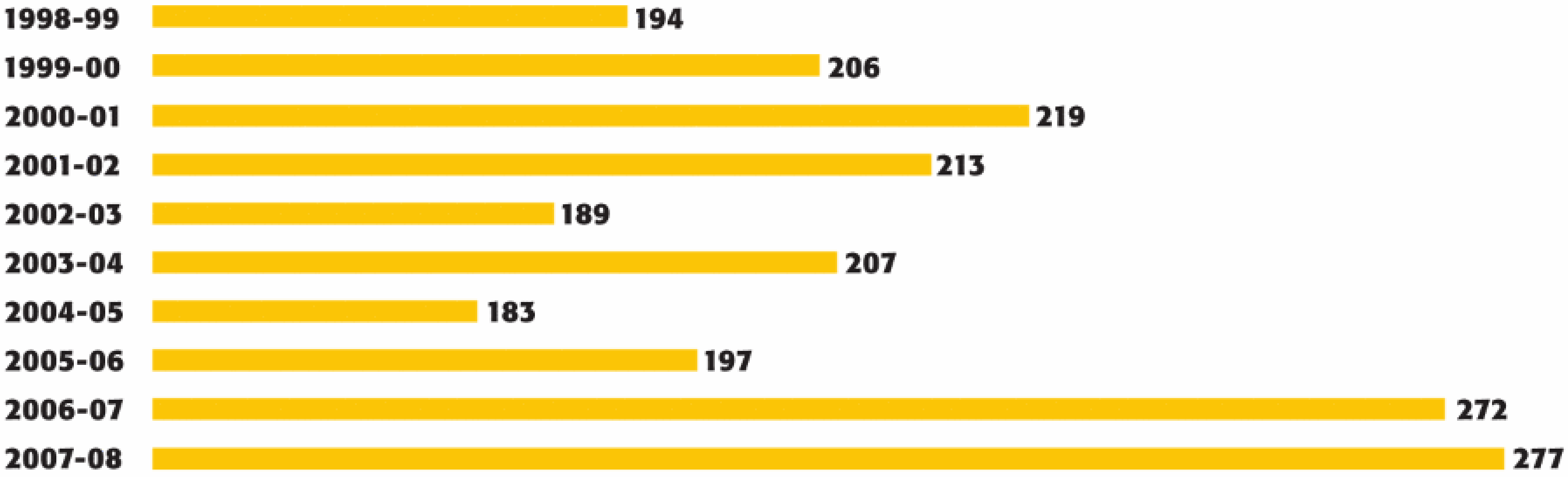
Total gross area maintained of all buildings
(including corridors and other common and office areas)
(by responding institutions)

Less than 150,000 sq. ft.	7%
150,000 to 299,999 sq. ft.	11%
300,000 to 449,999 sq. ft.	17%
450,000 to 599,999 sq. ft.	14%
600,000 to 749,999 sq. ft.	12%
750,000 to 999,999 sq. ft.	13%
1 million sq. ft. or more	15%
No answer	11%

Total grounds acreage maintained
(by survey respondents)



Square footage maintained
The amount of square feet of building maintained per full-time-equivalent (FTE) student at colleges over the past decade (in median square feet):



34,084 Amount of square feet maintained per custodian.

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M&O budget

(of survey respondents)

$850,000 Annual amount the median college spends on energy (gas, electricity, other fuels).

Number of buildings at institution

1-4 buildings	8%
5 to 10 buildings	19%
11 to 15 buildings	10%
16 to 25 buildings	19%
26 to 40 buildings	18%
More than 40 buildings	20%
No answer	6%

Data analysis

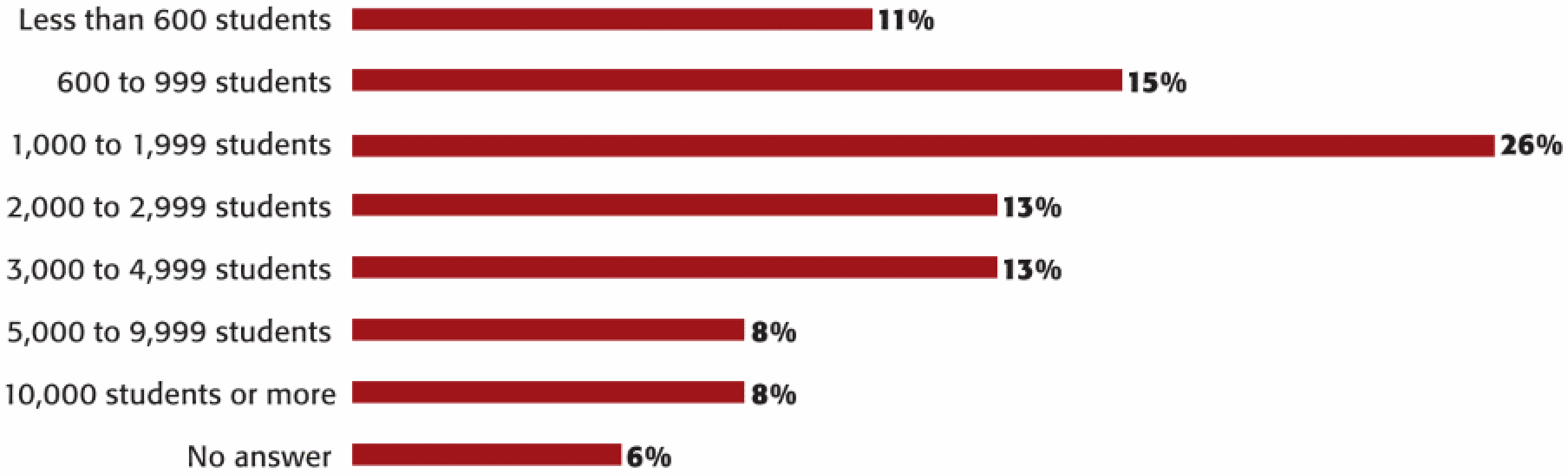
Following are medians for the 2007-08 school year:

Sq. ft. of bldg. maintained per student	277
Sq. ft. maintained per custodial employee	34,084
Sq. ft. maintained per maintenance employee	69,873
Acres maintained per grounds employee	22
Total reported M&O Budget	**$3.03 million**

277 Amount of square feet of building maintained per student.

FTE enrollment

(of responding institutions)



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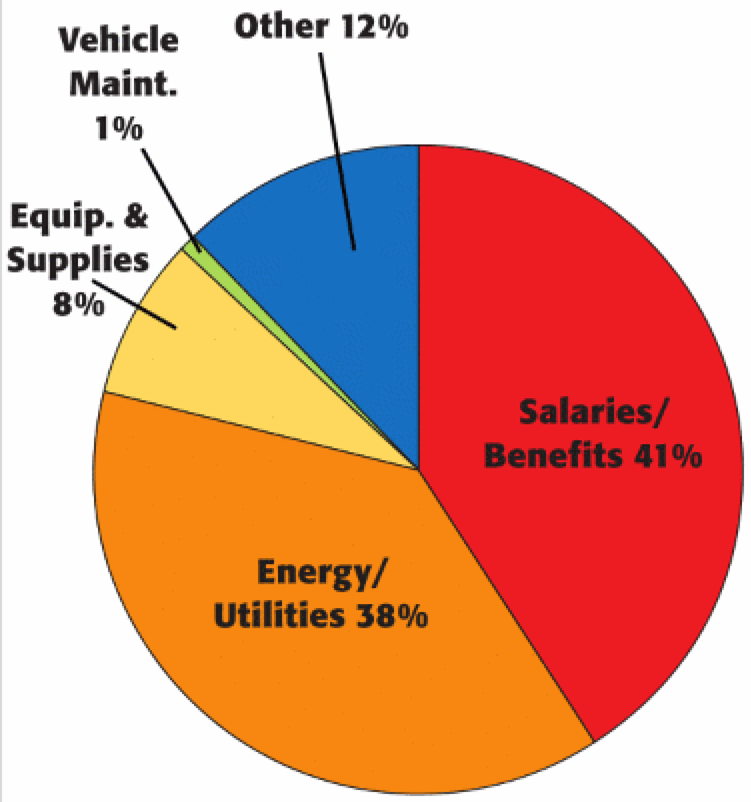
How the M&O budget is split

(median dollars per FTE student)



69,873 Amount of square feet maintained per maintenance worker.

Median M&O salaries and number of employees at colleges

(Full-time employees)

Function	Salary	# of Employees
Administrative	$56,333	3
Custodial/Housekeeping	$23,004	15
Grounds	$27,823	4
Maintenance	$35,661	8
Secretarial/Clerical	$28,217	1

■

Agron, editor-in-chief, can be reached at JAgron@ASUmag.com. For more exclusive research, visit ASUmag.com.

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The Right Light

Planners should carefully select the size and types of windows in a school facility to maximize the benefits of daylighting.

By Mike Kennedy

In the 1970s, concern about a looming energy crisis led many designers to shy away from the practice of relying on daylight to illuminate classrooms and other school spaces. Fluorescent lights could make up the difference, and with fewer openings for windows, a school building would not have so much of its heating and cooling energy leak out.

Today, schools and universities still fret about wasting energy, but windows no longer are seen as an enemy of energy efficiency. For the last decade or so, schools and universities have recognized daylight as a critical item in the recipe for energy conservation and as a desirable classroom characteristic that can enhance student performance.

CONTINUED...

So, the more windows, the better, right? Not so fast.

As planners have refined their energy-conservation strategies and developed more sophisticated ways of using daylight, they have learned that not all daylight is desirable and not all window types deliver it effectively. Schools and universities need to plan carefully to choose the right amount and the right type of windows.

Helping to see the light

Here are some sources on the World Wide Web for information about daylighting:

- The Daylighting Collaborative: www.daylighting.org
- Daylight Dividends: www.lrc.rpi.edu/programs/daylighting/
- "The Guide for Daylighting Schools:" www.lrc.rpi.edu/programs/daylighting/pdf/guidelines.pdf
- "Daylighting in Schools," the 1999 report that Heschong & Mahone Group completed for Pacific Gas & Electric Co.: www.pge.com/includes/docs/pdfs/shared/edusafety/training/pec/daylight/SchoolDetailed820App.pdf
- The Collaborative for High Performance Schools, Best Practices Manual, Design-Lighting and Daylighting: www.chps.net/manual/documents/BPM_2006_Edition/CHPS_II_2006_Lighting_and_Daylighting.pdf
- The U.S. Department of Energy's Building Technology Program, Daylighting: www.eere.energy.gov/buildings/info/design/integratedbuilding/passivedaylighting.html
- "Tips for Daylighting with Windows:" http://windows.lbl.gov/daylighting/designguide/dlg.pdf
- The Los Alamos National Laboratory Sustainable Design Guide: www.eere.energy.gov/buildings/highperformance/lanl_sustainable_guide.html
- Energy Design Resources: www.energydesignresources.com/resource/163 and www.energydesignresources.com/docs/db-01-glazing.pdf
- The Efficient Windows Collaborative: www.efficientwindows.org

Out of the glare

If you think all daylight is desirable, try driving a car west at dusk. The blinding glare can make driving uncomfortable if not hazardous. In the same way, allowing the glare of sunlight to enter a classroom and shine directly on the faces of students and teachers can hinder learning.

"Direct sun penetration into classrooms, especially through unshaded east- or south-facing windows, is associated with negative student performance, likely causing both glare and thermal discomfort," says an often cited report from Heschong Mahone Group on daylighting in schools.

In addition, direct sunlight brings with it unwanted heat that boosts energy consumption and ultraviolet rays that can cause degradation of materials in a learning space.

"A properly daylighted building uses carefully placed windows, shading devices and low-transmittance glass—techniques that block direct sunlight and greatly reduce glare," says the Daylighting Collaborative, which was created by the Energy Center of Wisconsin.

Put it there

Building designers seeking to maximize daylighting should orient the facility on an east-west axis. That "will allow for capturing winter solar gain and reducing unwanted summer sun that strikes the east- and west-facing surfaces," says the U.S. Department of Energy's Building Technologies program.

Careful window placement also helps a building realize its daylighting potential. Windows facing north and south create the fewest problems.

"By employing south-facing apertures, you create a situation that is easy to control through the use of external window-treatment strategies," says the "Design Guide for Daylighting Schools," put together by the architectural firm Innovative Design. "In the summer, the least amount of radiation hits the south, vertical surface of your school; and in the winter, the most radiation strikes this surface."

Going higher

The best way to bring natural light into a facility without detracting from the learning process is through high openings that are not used by occupants for viewing the outside environment. Commonly used techniques include clerestories, light shelves, roof monitors and skylights.

Clerestories are windows along a wall and above eye level. Because of their height, they allow daylight to penetrate deeper into a space. Lightshelves that are perpendicular to the clerestories can reflect the daylight and transmit it even farther into a room. Roof monitors—a vertical glazing atop a facility—admit daylight through the ceiling.

Architectural elements such as overhangs and other elements, such as baffles and shades, can further diffuse and filter the daylight.

"The Design Guide for Daylighting Schools" recommends that planners consider roof monitors first and lightshelves second.

"Roof monitors that incorporate vertical, south-facing glazing, properly sized overhangs and interior baffles have an advantage because they create uniform daylight throughout the space," the guide says.

South-facing lightshelves are the next best option, the guide asserts. They can be used in multi-story facilities and typically cost less than roof monitors.

A flat, uncontrolled skylight on a roof "is typically the worst energy choice when considering daylighting options," the guide says. It delivers more sunlight

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in the summer than in the winter, the opposite of what is desired.

Taking control

The effects of daylighting are enhanced when the design provides ways to adjust lighting when conditions change.

That could mean dimmers, and occupancy- or photosensors. Many teachers prefer to be able to control light in their classrooms manually.

"The Design Guide for Daylighting Schools" says glazing choices should be based on whether a window is to provide a view or bring in daylight.

"Make a clear distinction between glazing that is incorporated for views and ventilation, and that which provides daylighting," the guide says.

For windows that are used specifically for daylighting, clear glass is better than glazing with a low-E coating, the guide states. Low-E coatings reduce the amount of visible light transmitted and diminish the daylighting benefit.

Computer software packages have been developed to help school planners find the most effective daylighting plan. But even with the help of technology, schools and universities have to take into account the unique conditions and characteristics of each building.

"Daylighting will always be a mix of art and science, of logical thinking and common sense," says the Daylighting Collaborative. "Climate and geographical region, building type and use, and building orientation are big factors in designing a successfully daylighted building." ■

Send comments to Kennedy, staff writer, at mkennedy@asumag.com.

NOTABLE

75% to 89%

Solar transmission of clear single-pane glazing.

45% to 50%

Solar transmission of clear, double-pane low-E glazing.

30% to 45%

Solar transmission of low-E, tinted grey glazing.

Source: Daylight Dividends, Lighting Research Center, Rensselaer Polytechnic Institute, "Guide for Daylighting Schools"

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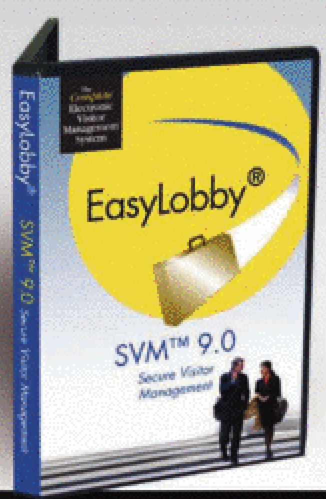

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Spread the Word

Technology helps school personnel communicate more effectively with the community and each other.

By Mike Kennedy

You can find them just about everywhere on a school or university campus, and most of us probably take them for granted. Whether it's big hands and little hands on an analog system, or a display of numerals on a digital system, clocks provide valuable information that helps keep students, instructors and everyone else who works in or visits schools on schedule.

Well, that's what is supposed to happen if the clocks are working right. But when the time shown on the classroom wall doesn't match what is displayed in the cafeteria or the teachers' lounge, problems can creep up: tardy students, missed buses, late assignments, irritated instructors and an entire campus

ever-so-slightly out of sync.

Considering all the issues that schools and universities face, having clocks that run a few minutes behind is hardly a crippling predicament. But it can be an annoying and lingering nuisance, one that is time-consuming and expensive to correct—especially in a school system or campus with thousands of clocks that operate independently.

To correct the problem, education institutions can turn, as they have frequently done in recent years, to technology. Schools and universities can use their computer networks not only to provide Internet access, phone service and voice mail, but also to control their clocks, bell schedules and public-address systems.

The technology enables education institutions to take advantage of their existing infrastructure to communicate important information to students, staff and visitors more effectively.

Beneficial byproducts

It wasn't too long ago that when a teacher needed to convey some information to a parent, the most common avenue of communicating was a written note. It was hardly a fail-safe method—the reliability of delivery often depended on a student who may have had reasons to prevent parent-teacher dialogue. But it was the most practical solution available—there were few telephone lines in classrooms, cell phones were a rare luxury, and no one had ever heard of e-mails or the Internet.

Technology has made great progress in ending the communications drought in education. Nearly every classroom has computers connected to the Internet, which has allowed most teachers and staff members to have easy access to e-mail and other resources on the World Wide Web. Internet access in classrooms now is commonplace, but the advancements and innovations that have brought us to this point continue to push the envelope.

Education administrators see that their computer networks also have the capability and capacity to enhance school operations even more. With Voice over Internet Protocol (VoIP) systems, schools can provide telephones in every classroom and voice mail for all teachers and staff. Schools that have upgraded to wireless technology give students and staff even more options in where they send and receive information.

The systemwide computer network enables schools and universities to communicate quickly with students, staff, parents and the community at large through e-mails, voice mails and instant messages.

In addition, the networks can use Power over Ethernet (PoE) technology to operate clocks, bell schedules and public-address systems in schools and universities.

With the appropriate software, administrators from their desktop computers can control all the clocks throughout a school system—setting them accurately, synchronizing their display, and adjusting them for daylight savings time. The central-

Getting the message out

Vanderbilt University in Nashville, Tenn., last month began a new text-messaging service to notify students and others connected to the school about campus emergencies "that pose an imminent threat or danger to the Vanderbilt community."

AlertVU sends messages to the devices a subscriber chooses—cell phone (voice or text), landline, e-mail account or pager. The system is a 100 percent opt-in system, says Johnny Vanderpool, emergency management coordinator at Vanderbilt.

"The users give us the information about how they want to be contacted," says Vanderpool. "With an opt-in system, the data is more accurate."

The university encourages subscribers to have messages sent to many delivery points. Students also can sign their parents up for the system. "Some people have eight or nine delivery points listed."

Many students sign up for just one delivery—a text message sent to their cell phones. Vanderpool says that is unwise; cell phone companies give voice calls higher priority than text messages, he says, and if an emergency results in heavy usage of the cell network, delivery of a text message could be delayed and defeat the purpose of the alert system.

"Redundancy is the key word," says Vanderpool. "The more places a messages is sent, the more likely you'll receive it."

Vanderbilt plans to use the system only for emergencies that call for immediate notification and not for more general security warnings.

As of a few weeks after its introduction, some 13,000 people had signed up to receive alerts, says Vanderpool. With students, employees and others connected with the campus, Vanderpool estimates that there are about 34,000 potential subscribers to AlertVU.

Internet access in classrooms now is commonplace, but the advancements and innovations that have brought us to this point continue to push the envelope.

ized management spares custodians from the time-consuming chore of resetting clocks manually.

Such PoE systems also enable administrators to set and synchronize bell schedules and choose the sound that will alert students and staff that a class period has ended. When bad weather or in-service programs necessitate a temporary change in the class schedule, administrators can adjust the schedule for an entire school system, or for just one campus.

School officials also can connect a public-address system to the computer network and use PoE to transmit audio announcements. Software enables administrators to target the message to specific locations or throughout the organization.

In addition to simplifying operations, the PoE applications allow schools and universities to provide communication services without having to install and maintain a separate infrastructure.

Instant news

With the proliferation of cell phones, schools and universities have a sizable audience able to receive information about events and issues.

In the wake of last year's deadly shooting rampage at Virginia Tech, many campuses have accelerated efforts to establish an emergency text-messaging system to alert students and others on campus of immediate crises. (See sidebar, p. 44). Many schools also are using text messaging to relay non-emergency information to parents—the kind that students might forget to share, such as when report cards will be sent home.

In the Jefferson City (Mo.) district, parents and other interested parties can sign up for Text JCPS or Voice JCPS and receive text or voice messages from school officials. The notices may involve school emergencies, but also cover more mundane announcements, such as school closings, early dismissals, and reminders of PTA meetings and other events. Parents can choose to receive messages related to specific schools or activities. ■

Kennedy, staff writer, can be reached at mkennedy@asumag.com.

NOTABLE

11 million

Estimated number of U.S. wireless phone subscribers, December 1992

256 million

Estimated number of U.S. wireless phone subscribers, March 2008

Source: CTIA-The Wireless Association

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Many institutions are raising awareness of global warming on campus. (Swarthmore College, Swarthmore, Pa.) Photo courtesy of Jim Graham

Call to Action

An energy master plan can provide a cohesive solution to reduce maintenance and operations costs at education institutions.

By Charles Craig and Bob Kennedy

In the education community, there is an overwhelming acceptance of global warming. In fact, a number of education organizations have raised calls to action and are assuming leadership roles to reduce greenhouse gas (GHG) emissions and lower their carbon footprints.

For instance, the American College and University Presidents Climate Commitment (ACUPCC) spells out actions that colleges and universities can take to help combat climate warming. More than 500 colleges and universities have signed the ACUPCC. The goal is for signatory campuses to become carbon neutral over time. Many other institutions have made commitments or are being required to meet relevant regulatory requirements.

Improving energy efficiency is the most effective strategy for reducing greenhouse gases, whether or not institutional leaders choose to commit to a formal accord. As Eberhard K. Jochem noted in *Scientific American*, (September 2006) " ... developing a comprehensive [energy] efficiency strategy is the fastest and cheapest thing we can do to reduce carbon emissions."

The most effective way to reduce energy consumption is to audit the energy use on a campus and uncover opportunities to improve energy efficiency. This is one step in a successful campuswide energy master plan. Reducing energy consumption in an individual building is helpful, but an energy master plan for an entire campus integrates all facility needs into an even more efficient long-term plan.

Energy master planning in elementary and secondary school districts can provide a cohesive solution for an entire system and pool all of the advantages of having multiple buildings. A master plan can provide a comprehensive maintenance and operating plan, rather than focusing on a single building. Such a plan can reduce maintenance and operating costs by an additional 30 percent.

A thorough campus energy master plan will take into account a campus' past, present and future energy usage. Upon completion, it will evaluate campus, economic and climate benefits and provide approximate costs for carrying out the recommendations.

Step by step

Here is a step-by-step look at the elements of a campus energy master plan:

1. Benchmark existing conditions, and identify funding.

Campuses should accumulate data from all significant sources, determine their carbon footprints, establish goals, agree on participants and identify funding opportunities (grants, special budgets or benefactors). Direct energy use for HVAC, lighting and transportation will dominate the footprint.

Needs: Utility bills and emissions data.

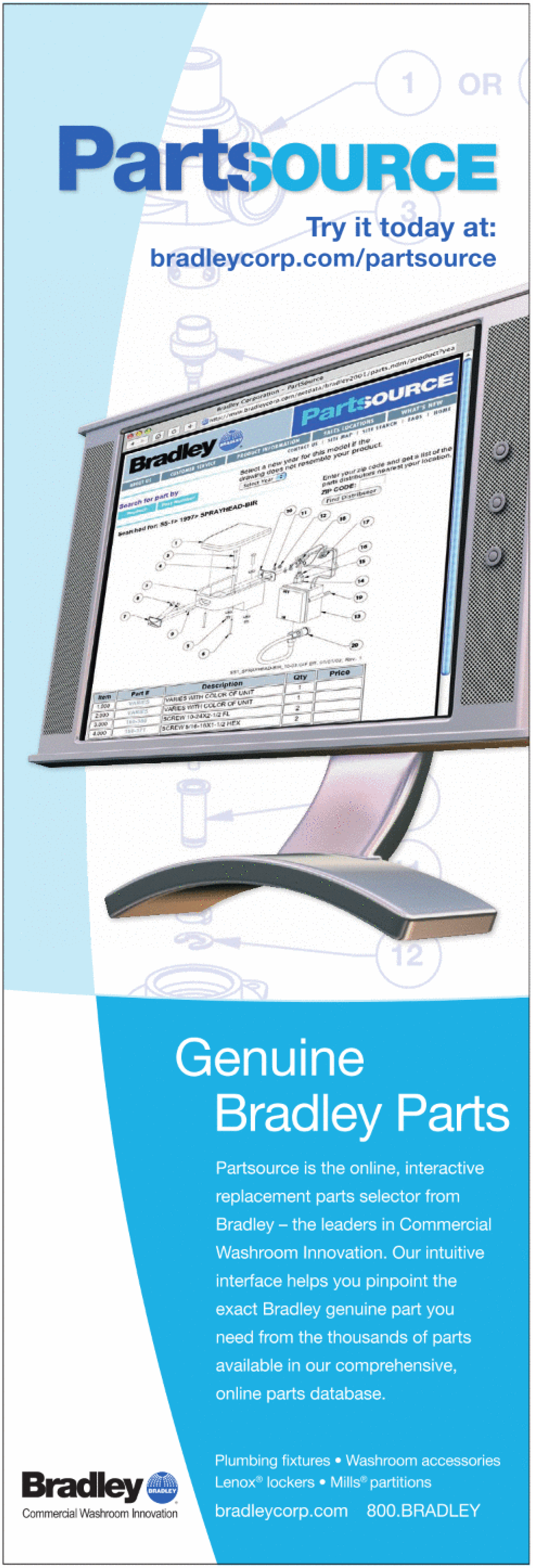
2. Building-by-building audit.

All buildings must be evaluated and prioritized for excess energy use and current operating needs. Analyze submetered data if available, and consider a plan for installing submeters. The audit should include at least a review of major systems vs. needs. Spot equipment metering and component level analysis also is possible.

Needs: Trained audit engineers are needed for this effort. Consider consultants or state programs.

3. Determine low- or no-cost upgrades.

Low- or no-cost efforts can yield 5 to 10 percent energy reduction. These strategies include aggressive occupancy-based shutting or slowing down HVAC equipment, modifying temperature set points and reducing ventilation air to match only what is required for occupants. Restore comfort at pre-agreed times to avoid



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Energy-efficiency measures at the Unified Science Center, Hamilton College, Clinton, N.Y., include geothermal heat pumps, skylights, tinted windows and shading roofs. Photos courtesy of Woodruff/Brown (atrium) and Michael Moran (exterior)

occupant resistance.

Needs: Scheduling input from building users and system descriptions.

4. Identify retro commissioning opportunities.

Mechanical/electrical/plumbing systems in many buildings can lose their efficiency, or in some cases, provide services that no longer are needed. If spaces no longer have lab hoods or cooking equipment, ventilation rates should be reduced. Ensuring that valves and dampers operate as intended (throughout their full range, shutting tight when intended) often can create savings and improve comfort. Studies show that retro commissioning pays for itself within nine months.

Needs: Retro commissioning via dedicated in-house labor or consultants.

5. Discover retrofit opportunities.

In many cases, newer technologies can be applied to existing systems, greatly improving efficiency. Lighting-efficiency upgrades, variable speed drives, CO_2 sensors, natural cooling cycles and control enhancements normally make good financial sense when applied correctly. Perform economic evaluation or upgrades to determine payback.

Needs: History of energy-efficiency upgrades and plans for future maintenance and equipment replacement, and information on energy-efficiency incentive programs.

6. Optimize new design and major renovation potential.

For every construction or renovation project, set a new standard for sustainability and lower energy consumption. Use computerized modeling to optimize site orientation, building glazing and insulation, lighting, HVAC system selection and occupancy-based controls. Evaluate application of heat recovery and dedicated outdoor-air systems, and commission all construction to make sure that all energy and comfort systems are working as intended before the engineers and contractors lose interest.

Needs: Communicate existing standards and guidelines for major construction projects.

NOTABLE

30 Percentage that maintenance and operations costs can be reduced with a campus- or districtwide energy master plan.

7. Evaluate renewable or alternative energy sources.

Evaluate options for future energy sources, striking the right balance between low cost and environmental footprint. Consider buying renewables and systems with a reduced carbon footprint, such as photovoltaics, ground-source heat pumps or cogeneration. Develop an emissions trajectory showing likely results with planned new buildings and varying assumptions on reductions and renewables.

Needs: Environmental data, such as wind and solar, and knowledge of the local renewable-energy market.

8. Procure purchased energy wisely.

Beyond using less or producing your own renewable energy, an energy master plan can develop strategies for buying from low-cost and less-polluting sources. Renewable energy credits (RECs) and carbon offsets can help meet GHG reduction goals.

Needs: Specialized expertise from dedicated procurement staff or specialty consultants.

9. Prioritize, summarize and communicate.

After you've completed these steps, gather results, establish criteria for evaluation, summarize anticipated outcomes, prioritize action steps, and communicate the process and results. Also, periodically reassess the process for future opportunities.

Needs: Expand on benchmarking. Establish appropriate adjustments for weather conditions and levels of use, in order to regularly assess progress.

Rainwater-harvesting measures at Swarthmore College, Swarthmore, Pa. Photo courtesy of Jeff Goldberg/Esto

10. Assess performance and re-evaluate opportunities.

The energy master plan is a process, not an event. Results come from constant attention and continual progress. See what worked well—or what didn't. Track activities and results over time. Communicate and celebrate positive steps. Create and distribute annual reports.

Needs: Persistence. Get new people involved and push the limits constantly.

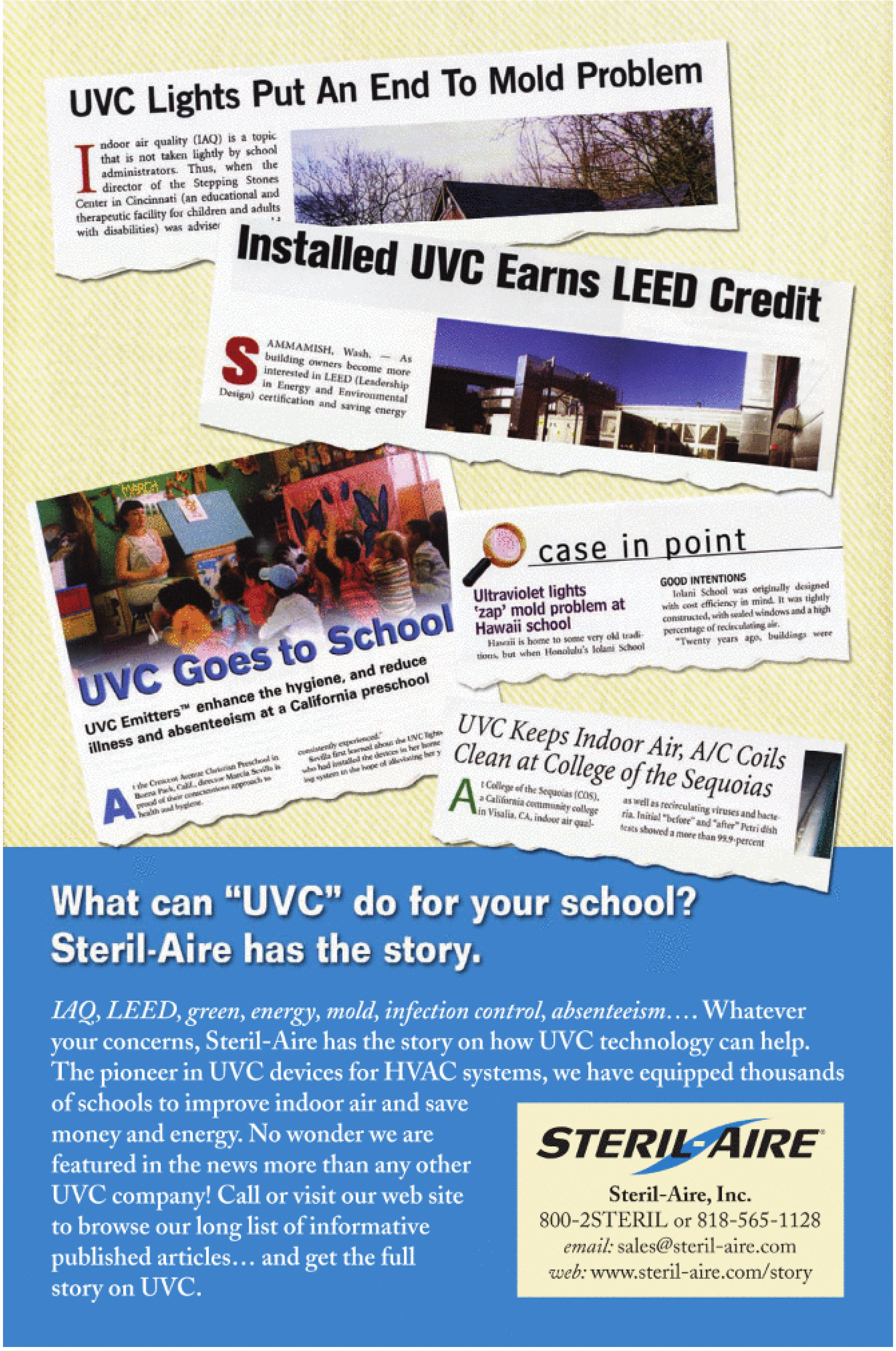
Reaping the rewards

Administrators can act independently at any institution to help reduce GHG emissions. Positive action does not depend on new buildings or long-range plans. Adjusting and improving existing building systems can save energy and advance the commitment to the ecosystems we share.

Education institutions can benefit from developing a campuswide energy master plan that considers student and teaching populations, campus layout and facility-use requirements. This demands an integrated team of facility design, construction and operations specialists, along with financial and energy-procurement analysts, to identify and achieve savings. K-12 and college campuses, even those spread miles apart, can embrace strategic techniques to reduce energy usage, boost recruitment efforts, and affect students and faculty alike.

With these measures, in the short term, your institution becomes more attractive for prospective students. In the long term, you will instill students and faculty with a lifelong eco-friendly attitude. ■

Craig, LEED AP, is a senior master planner and principal in Einhorn Yaffee Prescott's Boston office. Kennedy, PE, CEM, is director of EYP Energy Services in the firm's Albany office.



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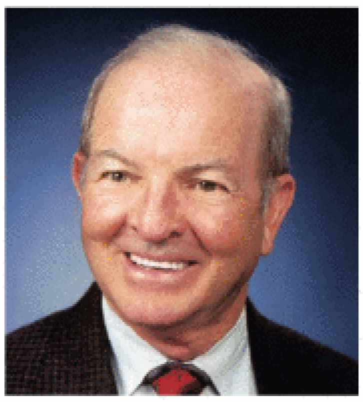
Match Points

Biometrics: Is it an option?

C. WILLIAM DAY



Day is senior analyst at KBD Planning Group, Young Harris, Ga., a firm specialized in educational facilities and technology planning. He can be reached at bday@kbdplanning.com. www.kbdplanning.com

In these trying times, educators are experiencing new security challenges. Recent events highlight one critical issue: safety. Technology is not a panacea for all such concerns—particularly those related to internal threats—but it can enhance security, access control and communications within schools. The question of the day: Is education ready for biometrics?

The greatest opportunity for biometrics to improve the school environment is in providing access control, positive identification and a record of those entering and leaving school buildings. Biometric systems are automated methods of recognizing a person based on a physiological or behavioral characteristic. Schools are using hand geometry and fingerprint identification to a greater extent as a standard for digital signatures and authentication for self-entry.

Some sophisticated systems incorporate biometric devices based on fingerprints, voiceprints and retinal patterns to control access to restricted areas. As camera technology improves and computer-processing costs decline, biometric systems are gaining acceptance as a viable method of access control. But the systems are not without problems. It turns out that people's fingerprint images are of varying quality. Some have defined grooves and valleys, but others have wornout fingers.

Fingerprint authentication has the following advantages over passwords, smart cards or tokens: In terms of security and convenience, a fingerprint can't be stolen for use by others; it can't be forgotten; and it is with a person all the time. For anyone responsible for security, those appear to be good reasons to jump at this technology. But administrators should consider other issues. How user-friendly and accurate is a fingerprint system? Look at measures such as false-acceptance rate (the percentage of impostors accepted) and false-rejection rate (percentage of authorized users rejected).

Educators need to be better informed to understand the value biometrics can bring to a security system. The industry as a whole must work harder to dispel misconceptions and separate the value that biometric user identification provides from "Big Brother" fears. We need to be clear that biometrics are part of a security system and can work harmoniously with other existing infrastructures to deliver better, more convenient security solutions. Another issue of consideration is privacy; as more personal data enters a system, who has access to it and how can it be used? These questions will need to be addressed.

Biometric systems will not prevent violence and threats, but establishing a controlled environment to which only authorized personnel have access enables other security measures to be more effective. A centralized access-control system also could make it possible to "lock down" part or all of a school during a crisis. ■

Celebrating Earth

Last-minute Earth Day ideas.

STEPHEN ASHKIN

Ashkin is executive director of the Green Cleaning Network, a 501(c)3 not-for-profit educational organization.
www.GreenCleaningNetwork.org
SteveAshkin@GreenCleaningNetwork.org

Over the years, I have written many articles encouraging facility folks to participate in Earth Day, which is April 22. Far too often our role has been limited to setting up and cleaning up, and we missed the opportunity to take part and let people know about the contributions of facility managers.

For those who have established green-cleaning programs, this year's Earth Day celebration can be an opportunity to explain just how big the annual environmental impact is from the institutional cleaning industry:

•8 billion pounds of cleaning chemicals, most of which are made from nonrenewable natural resources, such as petroleum.

•4.5 billion pounds of janitorial paper products, which require the cutting of about 25 million trees.

•1 billion pounds of janitorial equipment that is disposed each year—enough to fill 40,000 garbage trucks.

To that end, let everyone know that your institution's green-cleaning program is reducing negative health and environmental impacts. Plus, use the opportunity to tell them what they can do to make even greater progress.

For those of you still preparing for Earth Day, several steps can quickly and easily help you. First, talk to your vendors. Some of them have some terrific resources that can help you.

The second opportunity is through the National Environmental Education Foundation, which sponsors National Environmental Education Week, April 13-19. This year, the week is focused on carbon footprints. Participants have access to a variety of free environmental education resources, including:

•Standards-based environmental education lessons and activities, including special climate change educational resources and an online student carbon calculator.

•Monthly e-newsletters highlighting curricula, professional development and funding opportunities.

•Opportunities for online communication and knowledge sharing, including a special photo blog.

The link to the foundation's environmental health curricula is www.eeweek.org/resources/environmental_health_curricula.htm.

Some of the specific green-cleaning opportunities highlighted:

•Lutherville Laboratory for Science, Mathematics and Communications, an elementary school in Lutherville, Md., made a "green" detergent that students took home for use as a household cleaner. (www.bcps.org)

•As part of the Greener Learning Foundation's "Ban the Bag" campaign, students developed ways to curtail pollution from disposable garbage bags. (www.greenerlearning.org)

•Williamstown Middle School Community, Caring Gardens, Williamstown, N.J., prepared an exhibit on recycling and preventing non-point source pollution. (www.monroetwp.k12.nj.us) ■

Say it Again

Classroom acoustics: Can't hear? Can't learn!

JAMES E. RYDEEN

Rydeen, FAIA, is an architect/facility planning specialist and former president of Armstrong, Torseth, Skold & Rydeen, Inc. (ATS&R), Minneapolis. He can be reached at Jrydeen@atsr.com.

In many learning environments, acoustics are less than acceptable. Poor acoustics inhibit productivity and contribute to lower test scores.

Classroom Acoustics by the Acoustical Society of America says that in many classrooms, listeners with normal hearing can understand only 75 percent of the words read from a list. Deficient acoustics can cause even more problems for students who are English language learners or who have learning disabilities or auditory-processing problems. Young children also are more vulnerable because if they miss a few words, they are less able than older students to "fill in" the missing thoughts.

Virtually everything affects a building's acoustics: room volume and configuration; hard and soft surfaces; floors, walls, ceilings, doors, windows and room dividers; furniture, fixtures and equipment; activities and occupants; mechanical, electrical and technology systems.

Masonry and sealant cracks, foundation settlement and concrete floor cracks, moisture and humidity damage, and deteriorating sound barriers in walls, ceilings and folding partitions leave openings for sound penetration. Noise and vibrations from heating and cooling systems usually are the primary source of background noise in classrooms.

Three factors can help achieve a good listening environment:

•Avoid the speech-blurring effects of reverberation in a classroom with good internal acoustics.

•Eliminate distraction created by remote sounds from interior adjacent rooms or corridors, and exterior sounds generated by street or air traffic noises and playgrounds.

•Reduce background sound from HVAC equipment.

The American National Standards Institute's *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools* (ANSI S12.60) deals with four acoustical issues in classrooms: room acoustics; HVAC and electrical noise; classroom sound isolation from both interior and exterior sources; and impact isolation for multi-story classroom facilities.

The Air Conditioning and Refrigeration Institute (ARI), which has opposed adoption of the ANSI S12.60 provisions, commissioned a study and concluded that meeting ANSI S12.60 requires:

•Care in selecting, situating and applying HVAC equipment.

•Additional costs between 4 and 25 percent for classroom areas to meet the requirements.

•Closer supervision during construction to achieve the expected design; partition walls that did not meet the standard failed mainly because of poor construction quality.

Improving classroom acoustics adds costs. However, the increased construction costs are not significant compared with the importance of creating a healthful learning environment. ■

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Thermostat control

New HVAC controls provide personal, individualized comfort for students

Mitsubishi Electric HVAC. Three miles south of downtown Los Angeles, the Kappa Kappa Gamma House is situated on the 226-acre University Park Campus, part of the University of Southern California (USC). Built in 1966, the 20,000-square-foot, four-story facility is home to 83 students, and includes 30 dorm rooms, two computer/study rooms, a dining room, kitchen, media room, living room and the house director's living quarters.

The outdoor control units are hidden out of sight on the roof of the Kappa Kappa Gamma House at the University of Southern California, Los Angeles.

In November 2005, the first floor was flooded when the hydronics system for the second- and third-floor dorm rooms failed. In April 2006, bids went out to local HVAC contractors to replace the building's antiquated system with new cooling and heating systems. In addition to the top two floors (32 rooms were run off a 25-ton chiller and a boiler), there was the first-floor dining room, food-prep area and kitchen (serviced by a 10-ton gas/electric packaged unit); a 2-ton cooling-only heat pump for the media room; and two 3-ton fan coils tied to two 2.5-ton heat pumps for the basement and rest of the first floor.

A funding problem and an equipment shortage delayed the project start. Given the circumstances and tight deadlines, the board decided to switch to a CITY MULTI R2-Series Variable Refrigerant Flow Zoning (VRFZ) system with INVERTER technology and the ability of each system to simultaneously cool and heat. The project team had 20 days to complete the installation before the student board moved back into the house, and just 29 days until all residents were scheduled to move in.

Over three weeks, the crew replaced an aging 25-ton water chiller system and 32 hydronic fan coils with two CITY MULTI 9-ton heat pumps, a G-50A Centralized Controller, two CITY MULTI Branch Circuit (BC) Controllers and 32 8,000-Btu/h CITY MULTI wall-mounted indoor units–all key components of the CITY MULTI Controls Network (CMCN). The CMCN provides individual, personalized comfort for each of the 32 rooms and put overall HVAC management of the KKG House into the hands of the house director.

"Because of the CITY MULTI Controls Network, I can control the thermostats of every single room in the house from the computer in my office," says Donna Lou Guay, house director. "When I close the house and go on vacation, I can turn the entire system down to 72 degrees and have the peace of mind knowing that everything is under control."

Circle 316 for more information ■ freeproductinfo.net/asu

Smart cards

Access Smart LLC. Power LogOn Administrator enables school IT managers to pre-program, issue and revoke smart cards to students and faculty that will enable them to securely access various databases, websites and networks pertinent to their needs. Additional features such as cashless payments for food and supplies, as well as physical access to buildings and structures, also can be added.

Circle 300 for more information
freeproductinfo.net/asu

Washroom soap

Kimberly-Clark Professional. The KimCare Cassette Skin Care system offers interchangeable 1-liter cassettes of foam or lotion soap in eight different formulas. The refill cassettes slip into the dispenser for easy maintenance. A fresh pump in every refill improves hygiene and upgrades a restroom's image by eliminating the clogging and messy residue that can result when pumps are used.

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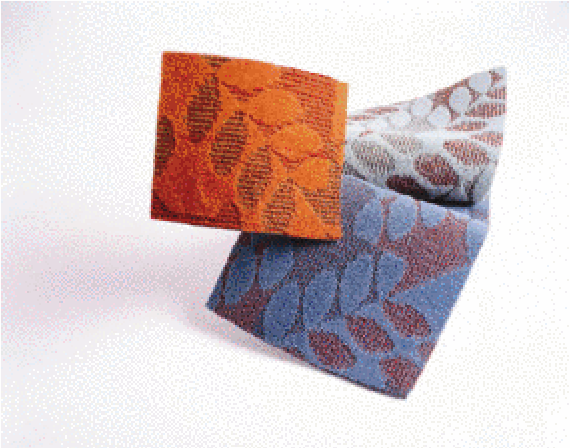

Modular carpet

Bentley Prince Street. The Saturnia Collection includes florals, scrolls and other smart patterns. It is inspired by the work of Italian designers Piero Fornasetti and Gio Ponti, whose dramatic contrasts in scale, the geometry of illusion and bold elements are translated in this collection. It offers 16 designs (12 modular and four broadloom). Fourteen of the 16 patterns are manufactured with 50 percent recycled nylon.

Circle 302 for more information
freeproductinfo.net/asu

Water-saving showerhead

Alsons Corp. Fluidics spray technology delivers a reduced flow and gives the user an ideal shower experience. The showerheads are available with a 1.85 gallons per minute (gpm) spray, a 1.75 gpm spray and a 1.6 gpm spray for a 3.6 percent water savings over the standard 2.5 gpm. The technology in the showerhead features a series of chambers that control the shape, velocity and thermal dynamics of water with no moving internal parts.

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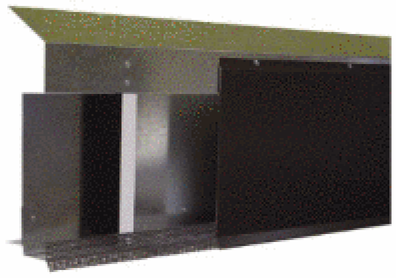

Roof ventilation

Metal-Era, Inc. Hi-Perf Vented Fascia is designed to provide maximum airflow at the roof's eave by taking into consideration the unique demands of commercial buildings such as longer runs, larger surface areas and lower pitches. Its custom sizes allow flexibility to accommodate a variety of roof conditions and ventilation requirements. It is available in both vented nailbase and attic-vented versions. Its all-metal construction eliminates wavy, untrue fascia board.

Circle 305 for more information
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CONTINUED...

Ceiling loudspeaker

Soundsphere. The Q-CS Power1 is a compact-powered loudspeaker with a built-in 15-watt amplifier for direct connection to projectors and computers. No additional equipment is required. It is designed for low, finished ceiling installations requiring clear voice announcements and full-range music reproduction, even at background levels.

Circle 303 for more information
freeproductinfo.net/asu

Circle 120 for more information ■ freeproductinfo.net/asu

Vo-tech storage

Career center finds solution for storing the tools of its trades

Four Rivers Career Center, Washington, Mo. Photo courtesy of Lista International

Lista International. Before moving into a new building, the Four Rivers Career Center, Washington, Mo., had to equip a number of educational shops—including areas where welding, automotive technology, machine tooling and collision repair are taught—to provide a hands-on setting for high school students.

Steve Matyas, the center's director, sought durable products that could stand up to hard use and still look good after 20 to 30 years. The storage products would provide much-needed organization, and their handsome appearance would reflect the center's high standards.

Machine tool shop supervisor Kirk Grass, whose previous shop had been outfitted with products from Lista International, spoke highly of the products' durability. The school's advisory committee, a group made up of local business people working in the industries for which Four Rivers students are being trained, also recommended the company.

Four Rivers purchased a variety of products, including heavy-duty storage wall systems to store heavy items such as copper wiring and pipes; drawer storage cabinets to house tools and parts; shelf cabinets that hold a variety of bulky items; and workbenches to provide durable work areas for a range of hard-use tasks.

In addition to providing a robust storage solution in the shop areas, the products have been integrated into the auto-repair classroom. From the butcher-block worksurfaces of the classroom work desks, to the protected storage of the hinged door cabinets with rollout trays, to the convenient storage of training manuals in overhead cabinets with Plexiglas doors, the classroom is a functional, handsome room.

The room often is used for staff meetings and presentations to outside visitors. "It's a super place to take them to show off our facility," says Matyas.

Circle 317 for more information ■ freeproductinfo.net/asu

Electronic lock system

Videx. The CyberLock system incorporates mechanical lock hardware that already is present in school buildings. Cylinders inside the existing locks just need to be replaced with the CyberLock electronic cylinders. This is done without the expensive costs of hard-wiring and structural changes. The cylinder cannot be picked, and the electronic key cannot be duplicated. A facility manager can audit access to sensitive areas because both the lock and key store a record of openings and denied entries.

Circle 306 for more information
freeproductinfo.net/asu

Seating collection

KI. The Strive Collection, which includes stack chairs, task chairs, cafe and task stools, and fixed seating, offers the comfort of an articulating chair to the widest possible audience. With a simple, elegant design based on a small number of components, Strive seating uses polypropylene with slats in the back to enable flexing. The collection comes in six different styles consisting of various frames, arm options, colors and upholstery selections.

Circle 307 for more information
freeproductinfo.net/asu

Emergency notification

PURVIS Systems Inc. PURVIS Emergency Notification System (ENS) is a secure, web-based notification system that allows school officials to reach either specific groups or an entire campus of students and staff with the push of a button. Messages including on-site emergencies, cancelled classes and weather warnings can be delivered in a matter of minutes and by a person's method of choice (text message, phone call, e-mail, etc.)

Circle 308 for more information
freeproductinfo.net/asu

Lighting fixture

Litecontrol. The Radi-X lighting fixture combines a traditional steel fixture body with a new baffle material called LiteCycle resin, which consists of 50 percent recycled content that can be recycled when removed from the building. The fixture was designed with classrooms in mind, and addresses the lighting needs of teachers and students through the indirect/direct lighting distribution option.

Circle 309 for more information
freeproductinfo.net/asu

Adaptable table

SICO. The new Elliptable is an excellent choice for cafeteria, conference room or boardroom applications. It features an elliptable space that is space-efficient and designed to improve sightlines. The table seats up to 10 people comfortably, and folds, rolls and nests for storage when not in use. It is available in a variety of laminate colors.

Circle 311 for more information
freeproductinfo.net/asu

Recycling receptacle

Rubbermaid Commercial Products. The contemporary design of Silhouette provides an upscale look in a recycling receptacle. All models are constructed of heavy-gauge steel (containing a minimum of 30 percent recycled steel) in Textured Black, Silver Metallic or Desert Pearl Uni-Koat powder-coated finishes or satin-finished stainless steel. Included with each receptacle is a leakproof, rigid plastic liner and adjustable leg levelers that provide stability on uneven surfaces. They are available in round or square, and a choice of three item-specific openings.

Circle 310 for more information
freeproductinfo.net/asu

Efficient chiller

Johnson Controls. The new YORK Tempo air-cooled scroll chillers offer low energy consumption and no ozone depletion, and qualify for a LEED point. Available from 70 to 150 TR, they use HFC-410A, a refrigerant with zero ozone-depletion potential and no phase-out schedule. They also employ an advanced refrigerant-circuit design that requires 30 to 50 percent less refrigerant than comparable models. They are self-contained and designed for outdoor (roof or ground-level) installation.

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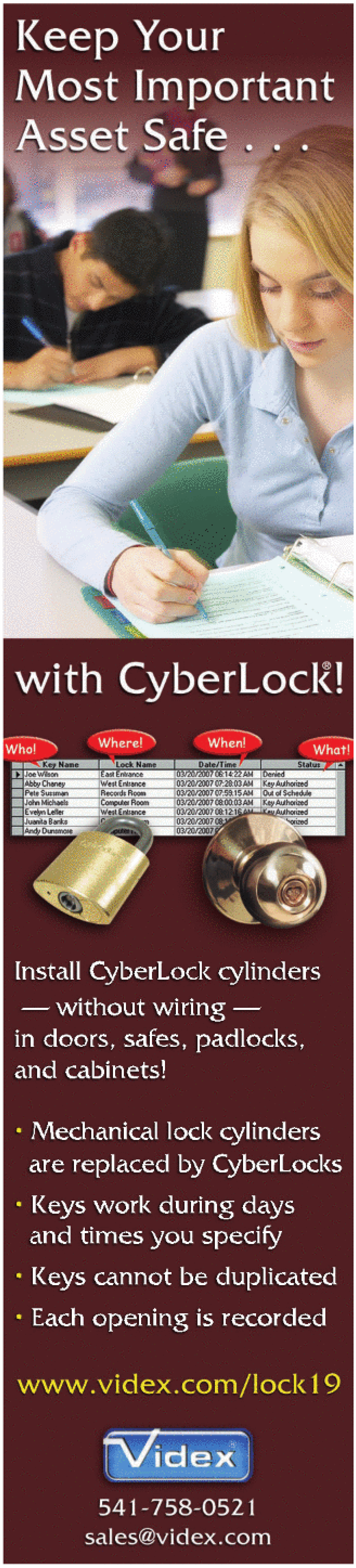

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Software upgrade

University upgrades financial systems to manage growth

University of Central Florida, Orlando

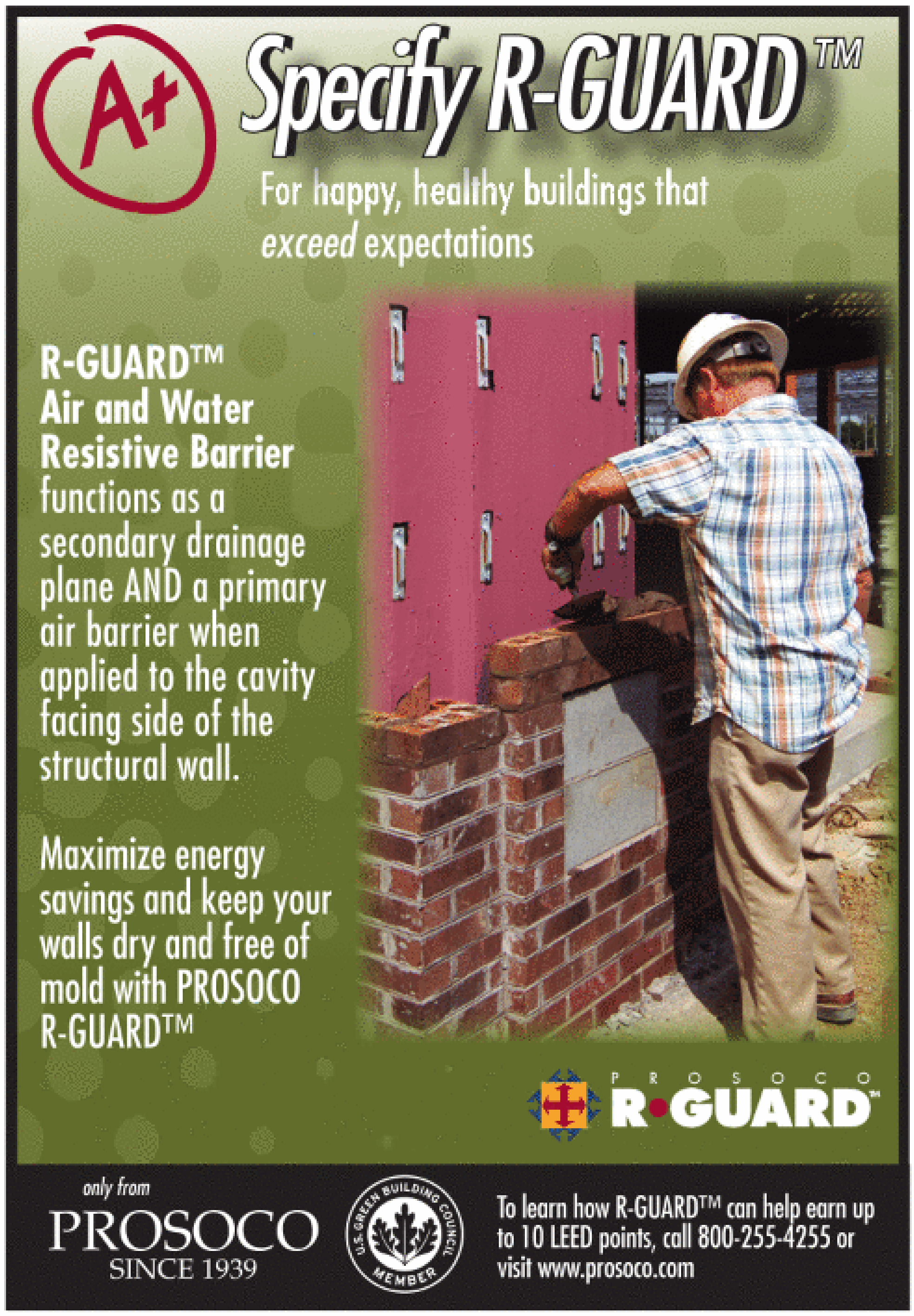
Oracle. Like the city in which it is based, the University of Central Florida (UCF) in Orlando has been shaped—and reshaped—by two major social and demographic forces: growth and change. Today, UCF has more than 47,000 students on 12 campuses and employs more than 9,000 faculty and staff.

Because of the university's rapid growth and the increasing complexity of its financial system, including a budget of $926.9 million, UCF was facing extensive issues with its software package. It had inherited a state-run package that had limited reporting capabilities and no Web resources. It also required long sequences of manual tracking procedures. To complicate matters, the state was phasing out the system for all 11 state universities.

The university decided to use Oracle's PeopleSoft Enterprise Financial Management on Oracle Database to build a more flexible financial-management platform.

UCF used the system to streamline requisition and purchase-order processes, enhance purchasing card and vendor tracking information, increase reporting capabilities, reduce costs, eliminate unnecessary paper trails and minimize redundant procedures. With PeopleSoft's Web capabilities, UCF centralizes system management while localizing access, allowing individual departments and employees to create online reports, and freeing IT staff to focus on other activities. UCF also integrated its financial system with other PeopleSoft Enterprise applications, further enhancing efficiency and improving service.

Circle 318 for more information ■ freeproductinfo.net/asu



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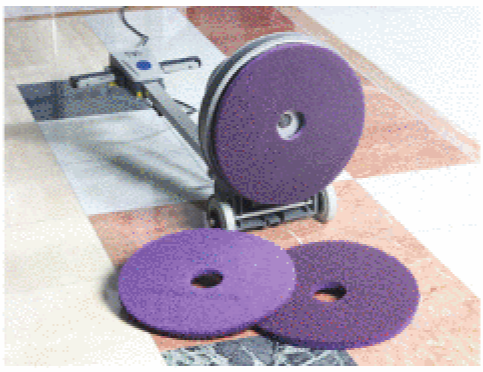
Floor pads



3M. The Scotch-Brite Purple Diamond Floor Pad Plus and the Scotch-Brite Sienna Diamond Floor Pad Plus system address the need of a floor coating while cleaning and polishing marble, terrazzo and polished concrete. The system can help save additional labor costs associated with burnishing floors after cleaning, and help eliminate the need for floor finish and other floor coatings that require additional maintenance. They feature uniform distribution of mineral abrasives throughout the pad, providing superior performance and extending the life of the pad.

Circle 313 for more information
freeproductinfo.net/asu

Safe evacuation

ZERO International. To help facilitate safe evacuations when power fails, the ZERO system includes directional markings and door signage designed to show the outlines of egress paths on floors, stairs, handrails and obstacles. Using top-grade strontium pigments, the material is non-electric and non-toxic. The photoluminescent strips and signs feature aluminum backing with foam tape for adhesion to uneven surfaces and can be fastened mechanically if preferred.

Circle 314 for more information
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Power management

Mobile classrooms make smart moves with plug-and-play connectors

Meltric, Inc. The 50-year-old Clark County School District, Las Vegas, is the fifth-largest school district in the United States and has 326 schools. The area is one of the fastest-growing population centers in the country. To meet the expanding need for schools, the district uses more than 1,300 portable classroom buildings that can be moved wherever there is a need for additional space until permanent buildings can be built.

Mobile classroom buildings such as this one being set up at Elaine Wynn Elementary School are easier to move since the district started using switch-rated plugs and receptacles instead of hard-wiring electrical power.
Photo courtesy of Tom Crocker

Each time a building is moved, electrical power must be disconnected and reconnected at the new location. Previously, this entailed disconnecting all the wiring and conduit before moving a building and repeating the process once the buildings are in place at their new location. Typically, it takes one or two journeyman electricians eight hours or more to run all of the needed conduit and wiring to reconnect one modular building.

Providing power to mobile classrooms now is easier with combination plug/receptacle and disconnect switches. The school system uses Meltric DE-CONTACTOR Series switch-rated plugs and receptacles that enable workers to safely and quickly make and break electrical connections that provide power to portable classroom buildings.

Thomas Crocker, electrical construction supervisor for the district's special projects department, estimates that the district's investment in the new plugs and receptacles will pay for itself by the second or third year, especially in labor savings.

"One of our goals is to cut down on the overtime needed to move and hook up the buildings. Another is to reduce the cost of wire, conduit and other materials we use," he says. "It's going to save so much time, material and labor expense in the future that it is well worth the investment."

Safety is another benefit of the new connectors. "They disconnect with a safe, quick press of the pushbutton pawl and then a twist," says Crocker, "and the female receptacles on the lines that come from the main distribution panel have a dead front that protects anyone from contacting live parts. Around children, that's a great thing because they can't hurt themselves, no matter what they do."

Circle 319 for more information ■ freeproductinfo.net/asu

Theater control

J.R. Clancy, Inc. Offline editing capability is now available for the SceneControl 500 automated motion-control system. Using SceneControl 500, operators can move scenery, lighting, acoustical banners, reverberation doors, travelers, speaker clusters, winches, revolves, orchestra lifts and more. Scenic designers now can prepare SceneControl 500 by downloading a show from the SceneControl 500 console to a laptop computer, and using the 3D interface to select battens and key in dimensions for each piece of hanging scenery. ■

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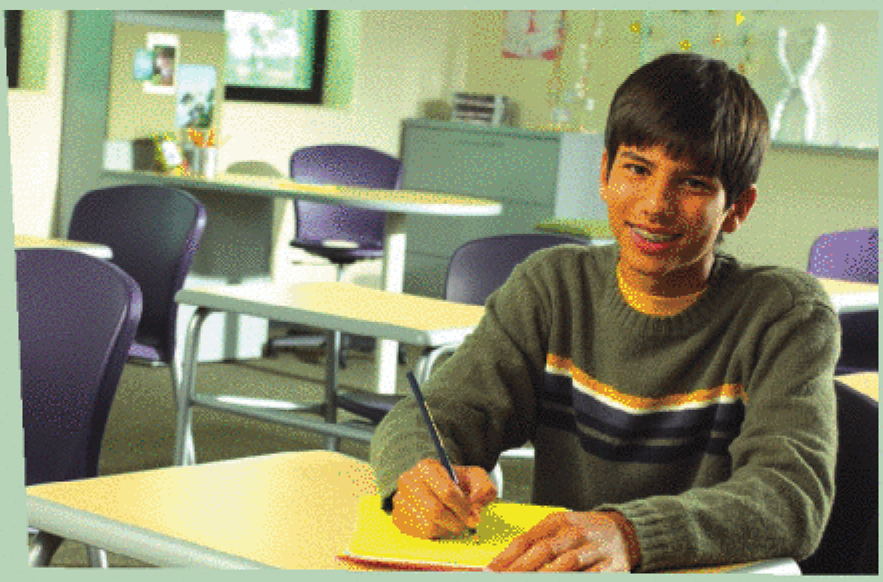

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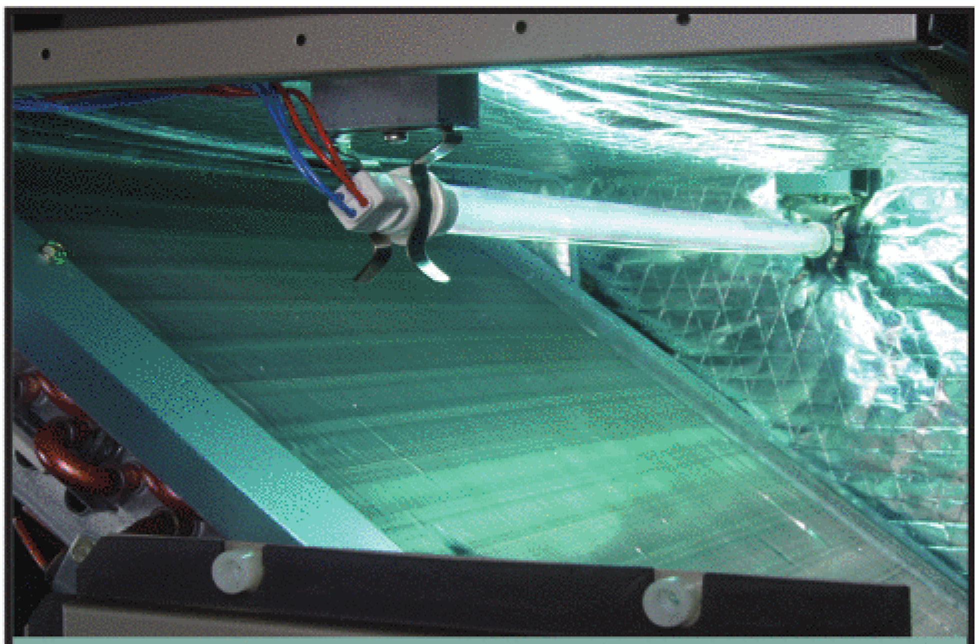

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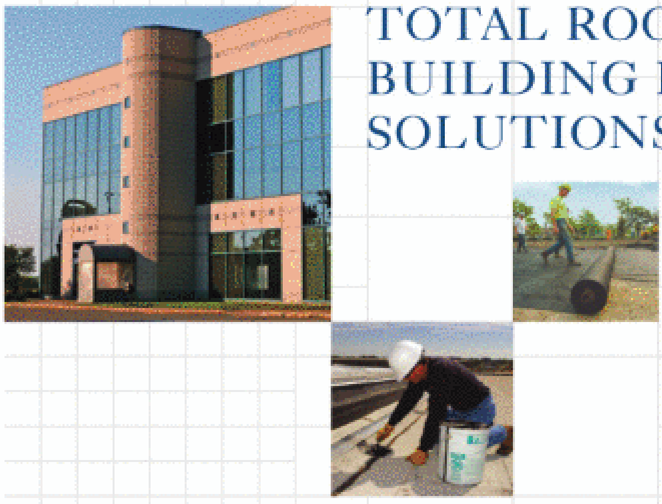

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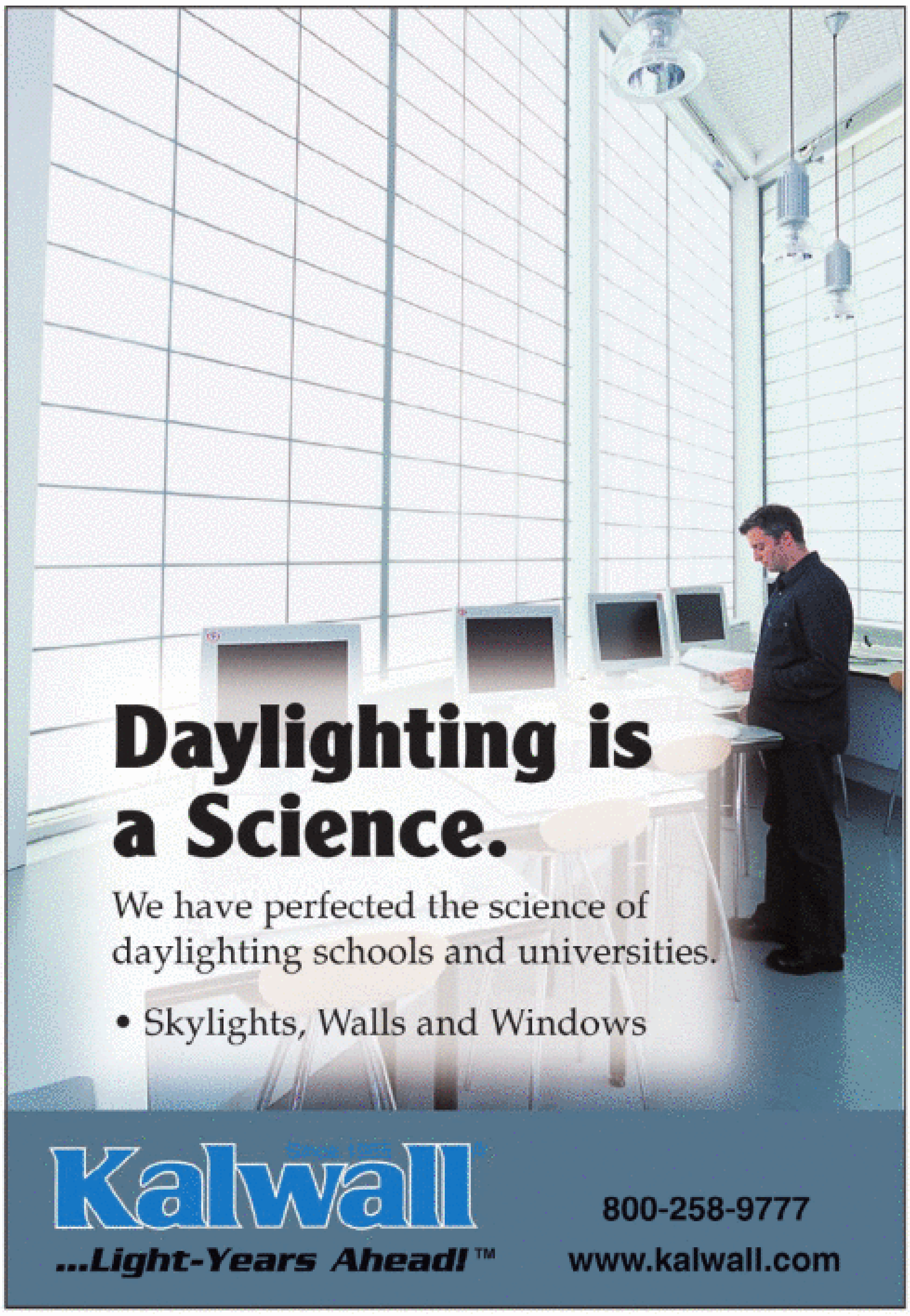

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New Bubblers Combine Heavy-Duty Design with Safety Features

Chicago Faucets classroom bubblers incorporate a sleek design with safety and durability. The line includes models with flexible heads that protect against injury and feature anti-microbial properties. Vandal-resistant features have also been added, including anti-rotation vandal-resistant pins that fasten the bubbler securely to the mounting deck to discourage tampering, and a recessed volume control that requires a hex wrench to adjust water flow.

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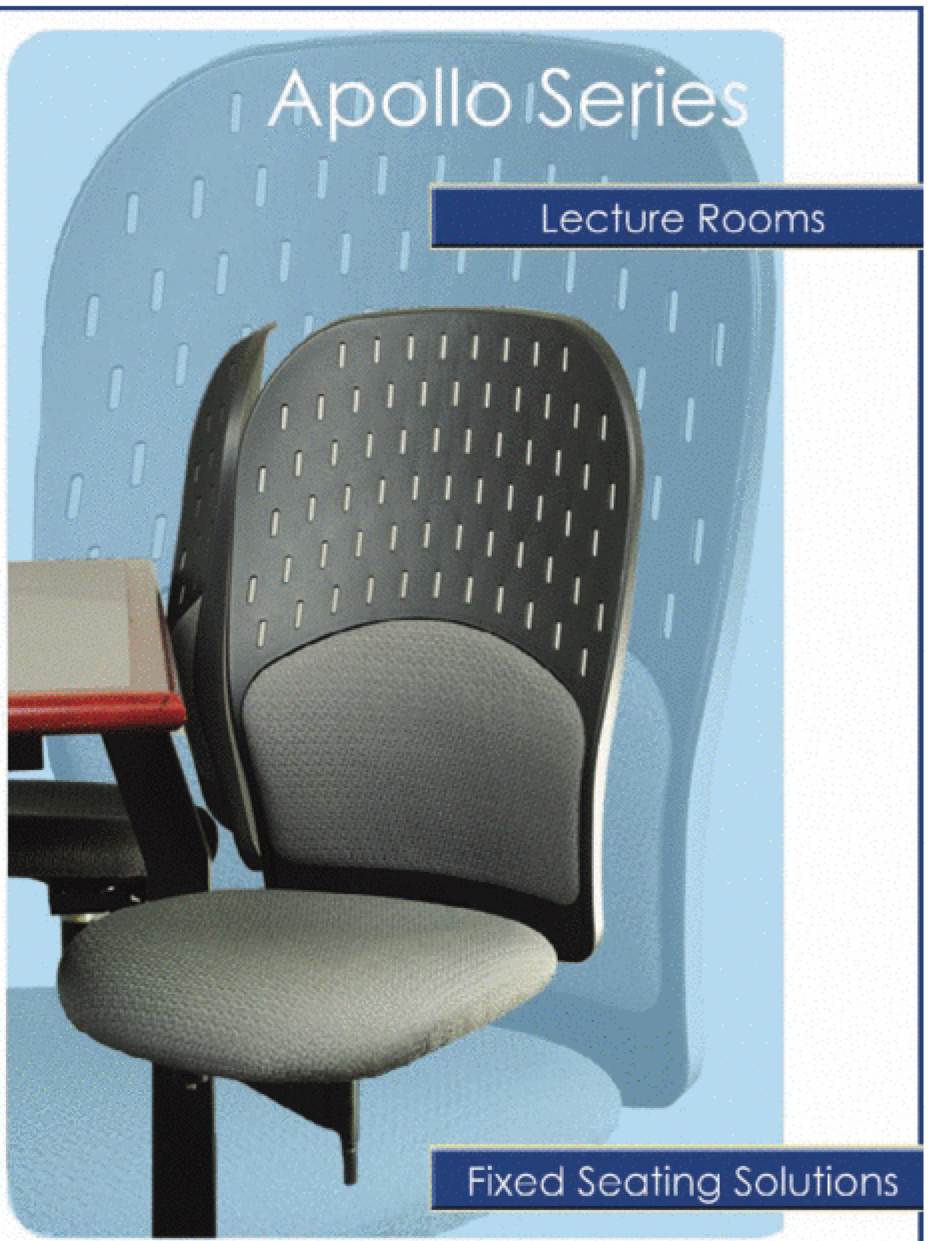

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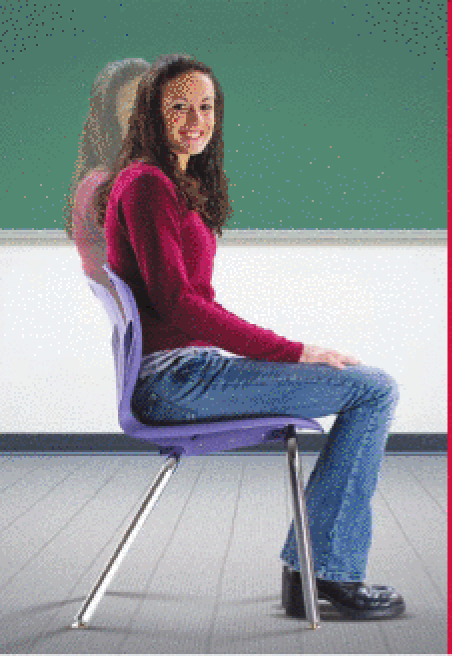

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